



24 April 2008

Ms. Demaree Collier
Remedial Project Manager
U.S. EPA, Superfund Division
77 West Jackson Boulevard,
Chicago, Illinois 60604

Subject: Transmittal of Data Evaluation Report
Phase 1 Remedial Investigation Characterization for Operable Unit 1
Mattheissen and Hegeler (M&H) Zinc Company Site

Dear Ms. Collier:

Please find enclosed three copies of the Data Evaluation Report for the Phase I Remedial Investigation Characterization for Operable Unit 1 (OU1) for the Mattheissen & Hegeler Zinc Company Site. If you have any questions or need clarification with regard to the information presented in the Data Evaluation Report, please contact Ms. Nandra Weeks, or in her absence, Ms. Teresa Fischer at (904) 388-8821. We look forward to working with you during implementation of the Phase 2 Remedial Investigation Characterization.

Sincerely,

Nandra D. Weeks, P.E.
Principal

Copy to: Paul Carus (Carus)
Tom Dimond (Mayer Brown)
Jennifer Knoepfle (SulTRAC)
Tom Williams (IEPA)

Enclosure



U.S. Environmental Protection Agency

Superfund Division

77 West Jackson Boulevard, SR-6J

Chicago, Illinois 60604

**DATA EVALUATION REPORT
PHASE 1 REMEDIAL INVESTIGATION
CHARACTERIZATION
OPERABLE UNIT 1**

***Mattheissen & Hegeler Zinc Company Site
LaSalle, Illinois***

Prepared by:

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On behalf of:



Carus Corporation

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LaSalle, Illinois 61301

Geosyntec Consultants Project Number FR1347

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List of Acronyms

ASAOC	Administrative Settlement Agreement and Order on Consent
AVS/SEM	Acid Volatile Sulfides/Simultaneously Extracted Metals
BLS	Below Land Surface
Carus	Carus Chemical Company
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
ft	Foot
IEPA	Illinois Environmental Protection Agency
M&H	Matthiessen and Hegeler Zinc Company Site
OU1	Operable Unit 1
OU2	Operable Unit 2
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
PPE	Personal Protective Equipment
PRG	Preliminary Remedial Goal
RI/FS	Remedial Investigation/Feasibility Study
SVOC	Semi-Volatile Organic Compound
TACO	Tiered Approach to Corrective Action Objectives
TAL	Target Analyte List
TOC	Total Organic Carbon
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1. INTRODUCTION

1.1 Overview

This Data Evaluation Report has been prepared as part of the Remedial Investigation/Feasibility Study (RI/FS) for the Matthiessen and Hegeler (M&H) Zinc Company Site located in LaSalle, Illinois. The RI/FS is required by an Administrative Settlement Agreement and Order on Consent (ASAOC), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Docket No.V-W-06-C-856, dated 6 October 2006, between United States Environmental Protection Agency (USEPA) Region V, Carus Corporation, and Carus Chemical Company (Carus). The ASAOC addresses Operable Unit 1 (OU1) of the site, which is defined as the slag pile area located adjacent to the Little Vermilion River, the Little Vermilion River and its sediments, and the Carus Chemical Company manufacturing plant. Operable Unit 2 (OU2) is defined as the remaining portion of the site not included in OU1, including the surrounding residential area. Section IX, Paragraph 33 of the ASAOC states that the RI/FS shall characterize the geology and hydrology of the site, determine the nature and extent of the contamination at or from the site, and characterize all ecological zones. This Data Evaluation Report has been prepared to: (i) summarize the field work conducted as the initial phase of the RI characterization fieldwork by Geosyntec on behalf of Carus; (ii) provide the results of the investigation; (iii) provide the Data Validation Reports; and (iv) outline proposed supplemental field work for Phase 2. The information contained within this report will be included in the RI/FS Report, which will be submitted at the conclusion of the RI fieldwork.

1.2 Site Description

OU1 is a portion of the broader M&H Zinc Company Site, located on the east side of LaSalle, Illinois. Figure 1 presents an overview of the site, which encompasses approximately 183 acres of defined property plus any off-property areas, such as the Little Vermilion River and the off-site residential areas which may have been affected by the site's manufacturing history. The site is divided into two operable units, as defined above. OU1 is comprised of three primary areas: (i) the Carus manufacturing facility (referred to herein as the main plant area); (ii) a slag pile related to the former M&H smelter operations; and (iii) the Little Vermilion River. The Carus manufacturing facility is located at 1500 Eighth Street in the northwest quarter of Section 14 and in the northeast quarter of Section 15 in Township 33 North, Range 1 East of the Third Principal Meridian in LaSalle County, Illinois. The slag pile is located in the northwest quarter of Section 14 in the township referenced above and is bordered to the east by the Little Vermilion River. The river generally runs from north to south toward its confluence with the Illinois River approximately one mile south of the site; it also serves as the eastern boundary of OU1 and OU2.

- if the slag terminated before 5 ft below the water table, the third sample was collected in the saturated zone 1 ft above the bottom of the slag; and
- if the bottom of slag was observed above the water table, then the second sample was collected 1 ft above the bottom of slag or 5 ft above the water table (whichever was higher), and the third sample was collected in alluvium at least 1 ft below the bottom of slag and up to 5 ft above the water table.

All solid matrix samples were analyzed for Target Analyte List (TAL) metals as they are the most prevalent chemicals present in soils and slag based on previous investigations conducted in the OU1 area. A subset of samples was analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and cyanide, as these chemicals have been measured in site media to a more limited extent than the metals. The relative percent of the subset analyzed is consistent with the relative observations measured in site media during earlier investigations at OU1. The samples designated for VOCs, SVOCs, PCBs, cyanide, and pesticides were selected on a rotational and sequential basis to ensure a randomly spatial sampling design (no bias as to sampling depth or location). Geochemical parameters were collected to evaluate fate and transport mechanisms and bioavailability in the soil and slag.

The slag characterization program also addressed the delineation of slag pile area depths, thicknesses, and volume related to OU1, as well as the elevations of the underlying natural soil layer and the extent of cover (if present) over the slag. Soil borings SB-301, SB-303, and SB-305 were advanced through the slag and underlying alluvium to the top of bedrock. During September through December 2007, test trenching was conducted with a backhoe to delineate the southern, northern, and western edges of the slag pile. Thirty-one trenches were excavated to evaluate the lateral boundaries of the slag pile area. Aerial photographs of the site were also reviewed to understand historical slag placement.

Personal/area real-time air monitoring/sampling was conducted in accordance with the Health and Safety Plan. Level C personal protective equipment (PPE) was implemented for trenching activities. PPE was downgraded to Level D for all field activities after receipt of favorable air monitoring results early in the trenching task.

2.3 Surface Water and Sediment Characterization Program

The Surface Water and Sediment Characterization Program addressed two areas of the site: (i) the Little Vermilion River; and (ii) the upland area of OU1.

2.3.2 Upland Characterization Program

Potential surface water accumulation pathways were predicted based on computer-generated flow maps using site topography. OU1 was traversed to visually observe surface water accumulation pathways. In addition, the site was observed following rain events for evidence of surface runoff and/or areas of accumulation.

2.4 Groundwater Characterization Program

In general terms, the goals of the groundwater characterization program are summarized as follows:

- perform sufficient groundwater characterization in the two most significant transport media, slag and alluvium;
- develop a sufficient understanding of background conditions, which primarily correspond to bedrock groundwater;
- conduct a limited characterization of other media, including fill and Pleistocene till;
- evaluate vertical gradients among media;
- perform an analytical sampling program that addresses all analytical parameters while focusing on those of greatest significance (i.e., metals);
- collect groundwater samples of consistent quality to avoid unnecessary variability in sample turbidity or well productivity;
- incorporate groundwater quality data generated in OU2; and
- perform representative hydraulic characterization of sampling media.

Multiple phases of field activities were implemented to meet goals of the Groundwater Characterization Program.

Prior to the initiation of the RI scope of work, a monitoring well network, consisting of 18 monitoring wells screened in bedrock, alluvium, and slag, existed in OU1. A reconnaissance of the existing well network was conducted in September 2007 to evaluate the competency of the wells for future sampling. Several years had passed since the wells were last developed, and some were in a state of disrepair. The wells were redeveloped and the turbidity closely monitored. The integrity of the well cap, pad, and locking mechanism were also evaluated. During September through December 2007, fourteen monitoring wells were added to the OU1 monitoring well network to supplement

3. REMEDIAL INVESTIGATION RESULTS

3.1 Overview

During the RI/FS, soil, groundwater, surface water, sediment, samples were collected and sent to a fixed-based laboratory for analysis. The results of the sampling analyses were compared to various screening values. Tables 1 through 5 provide summary statistics of RI/FS analytical results, including chemicals that were detected above laboratory detection limits.

3.2 Solid Matrix Characterization

Solid matrix samples were collected from soil borings at ten locations in the slag pile area and eight locations in the main plant area of OU1. The laboratory results for soil samples were compared to the USEPA Region 9 Preliminary Remediation Goals (PRG) for Soil – October 2004, and the Illinois Environmental Protection Agency (IEPA) Tiered Approach to Corrective Action Objectives (TACO) Tier 1 Soil Remediation Objectives for Industrial/Commercial Properties – February 2007. A summary of analytical results for all analyses is presented in Table 1 for shallow soils and Table 2 for deep soils. Analytical results for arsenic, benzo(a)pyrene, manganese, and lead in shallow soils are presented in Figures 2 through 5. Sequential Extraction Procedure results for arsenic are presented in Figure 6.

The boundaries of the slag pile and associated delineation trench locations are presented in Figure 7. The areal extent of the slag pile is 17.7 acres. The volume of the slag pile in OU1 was estimated to be 1.15 million cubic yards.

3.3 Surface Water and Sediment Characterization

Surface water samples were collected at eight locations, as shown in Figure 8, along the Little Vermilion River. The laboratory results for surface water samples were compared to USEPA Region 5 Ecological Screening Levels for Surface Water – August, 2003. A summary of analytical results for all analyses are presented in Table 3. Constituent concentrations of nine metals in surface water are presented for the study reach of the river in Figure 9.

Sediment samples were collected at 15 locations, as shown in Figure 8, in the Little Vermilion River. The laboratory results for sediment samples were compared to USEPA Region 5 Ecological Screening Levels for Sediment – August, 2003. Table 4 lists summary statistics of analytical results for all analyses. Constituent concentrations of seven metals in sediments are presented for the study reach of the river in Figure 10.

3.5 Ecological Habitat Characterization

The primary observations of the ecological habitat characterization are provided below.

- The Carus main plant area of OU1 is an active industrial complex dominated by building structures and impervious surfaces that provide little or no ecological habitat. The main plant area will remain that way for the foreseeable future.
- The slag pile area of OU1 is highly disturbed; selected areas are in recovery. Some terrestrial habitats present supporting mammalian and avian receptors. The Little Vermilion River and associated riparian area is the most prominent ecological habitat feature of the site.

3.6 Data Validation Summary

Tier III data validation was conducted for the initial RI/FS scope on 100 percent of the laboratory data. Validation of the data was performed by an entity independent of the laboratory as specified by the Quality Assurance Project Plan. The October 2004 National Functional Guidelines for Inorganic Data Review were used as the basis for the validation of inorganic data and the January 2005 National Functional Guidelines for Organic Data Review were used as the basis for the review of organic data. These guidance documents provided structured approaches for the assignment of data qualifiers based on observations made in the data verification process and were used in conjunction with the specific USEPA method-specified criteria, as well as the quality assurance criteria set forth in the project-specific Field Sampling Plan and Quality Assurance Project Plan.

Site samples collected during the characterization work were submitted for the following analyses:

- VOCs (EPA Method 8260B);
- SVOCs (EPA Method 8270C);
- Pesticides (EPA Method 8081A);
- PCBs (EPA Method 8082);
- Total and Dissolved Metals (EPA Methods 6010B/6020);
- Total and Dissolved Mercury (EPA Methods 7470A and 7471A);
- SPLP of metals (EPA Method 1312); and

4. PROPOSED PHASE II REMEDIAL INVESTIGATION

Consistent with discussions during the 6 and 7 March 2008 meeting regarding the RI/FS, a scope of work has been developed to meet the objectives of the RI/FS set forth by the ASAOC. Proposed work for Phase II of the RI/FS includes the following:

- additional sediment and surface water sampling of the Little Vermilion River, utilizing composite sampling across the transect of the river;
- assessment to evaluate the condition of aquatic and benthic macroinvertebrate communities in four reaches of the Little Vermilion River, adjacent to OU1/OU2 and including a reference point upstream of M&H;
- additional slag characterization to evaluate leachability;
- sitewide potentiometric gauging on a quarterly basis with continued cooperation with SulTRAC to evaluate groundwater conditions across the M&H site; and
- opportunistic groundwater sampling if OU1 water levels rise within the slag medium.

A Work Plan Addendum and associated documents, as appropriate, will be provided to the USEPA, IEPA, and SulTRAC for review and approval.

TABLES

Table 1. Summary Statistics for Shallow Soil (0-10' BGS) Sampling Results
Remedial Investigation/Feasibility Study
Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Analysis Method	CAS #	Parameter	# of Detections	# of Samples	Minimum Result (mg/kg)	Average Result (mg/kg)	Maximum Result (mg/kg)	Region 9 Industrial Soil PRG	IEPA Class II TACO
Cyanide	57-12-5	CYANIDE	0	8	ND	ND	ND	12000	4100
Metals	14808-79-8	SULFATE (AS SO ₄)	14	14	10	1960	10800	NA	NA
Metals	18496-25-8	SULFIDE	3	13	ND	3.24	19.7	NA	NA
Metals	3812-32-6	CARBONATE (AS CO ₃)	1	1	0.021	0.021	0.021	NA	NA
Metals	57-12-5	CYANIDE	7	35	ND	0.359	4.4	12000	4100
Metals	71-52-3	BICARBONATE	1	1	191	191	191	NA	NA
Metals	7429-90-5	ALUMINUM	57	64	ND	11700	35300	100000	NA
Metals	7439-89-6	IRON	45	52	ND	30700	160000	100000	NA
Metals	7439-92-1	LEAD	65	66	ND	1240	38700	800	700
Metals	7439-95-4	MAGNESIUM	42	42	627	15400	106000	NA	730000
Metals	7439-96-5	MANGANESE	54	66	ND	5690	123000	19000	4100
Metals	7439-97-6	MERCURY	54	66	ND	2.71	96	NA	0.1
Metals	7440-02-0	NICKEL	48	53	ND	88.3	2470	20000	4100
Metals	2023695	POTASSIUM	56	64	ND	2600	15900	NA	NA
Metals	7440-22-4	SILVER	20	64	ND	1.97	28.4	NA	1000
Metals	7440-23-5	SODIUM	43	50	ND	870	7600	NA	NA
Metals	7440-28-0	THALLIUM	39	63	ND	0.329	3.6	NA	160
Metals	7440-36-0	ANTIMONY	28	41	ND	4.47	30.4	410	82
Metals	7440-38-2	ARSENIC	57	64	ND	30.4	251	1.6	61
Metals	7440-39-3	BARIUM	64	66	ND	519	13800	67000	14000
Metals	7440-41-7	BERYLLIUM	52	63	ND	1.2	12.7	1900	410
Metals	7440-43-9	CADMIUM	61	66	ND	48.5	1320	450	200
Metals	7440-47-3	CHROMIUM, TOTAL	57	65	ND	22.8	167	450	NA
Metals	7440-48-4	COBALT	44	50	ND	17.8	273	1900	12000
Metals	7440-50-8	COPPER	63	64	ND	273	4340	41000	8200
Metals	7440-62-2	VANADIUM	45	63	ND	35.5	899	1000	1400
Metals	7440-66-6	ZINC	65	66	ND	9210	79900	100000	61000
Metals	7440-70-2	CALCIUM	46	64	ND	32100	192000	NA	NA
Metals	7782-49-2	SELENIUM	42	63	ND	2.97	43.9	5100	1000
PCBs	11096-82-5	PCB-1260 (AROCHLOR 1260)	1	9	ND	0.0081	0.073	0.74	NA
PCBs	11097-69-1	PCB-1254 (AROCHLOR 1254)	1	9	ND	0.0068	0.061	0.74	NA
PCBs	11104-28-2	PCB-1221 (AROCHLOR 1221)	0	9	ND	ND	ND	0.74	NA
PCBs	11141-16-5	PCB-1232 (AROCHLOR 1232)	0	9	ND	ND	ND	0.74	NA
PCBs	12672-29-6	PCB-1248 (AROCHLOR 1248)	0	9	ND	ND	ND	0.74	NA
PCBs	12674-11-2	PCB-1016 (AROCHLOR 1016)	0	9	ND	ND	ND	21	NA
PCBs	53469-21-9	PCB-1242 (AROCHLOR 1242)	0	9	ND	ND	ND	0.74	NA
Pesticides	1024-57-3	HEPTACHLOR EPOXIDE	1	17	ND	0.00023	0.0039	0.19	0.6
Pesticides	1031-07-8	ENDOSULFAN SULFATE	0	17	ND	ND	ND	NA	NA
Pesticides	11096-82-5	PCB-1260 (AROCHLOR 1260)	5	16	ND	0.13	1.1	0.74	NA
Pesticides	11097-69-1	PCB-1254 (AROCHLOR 1254)	9	16	ND	0.31	2.8	0.74	NA
Pesticides	11104-28-2	PCB-1221 (AROCHLOR 1221)	0	7	ND	ND	ND	0.74	NA
Pesticides	11141-16-5	PCB-1232 (AROCHLOR 1232)	0	7	ND	ND	ND	0.74	NA
Pesticides	12672-29-6	PCB-1248 (AROCHLOR 1248)	0	7	ND	ND	ND	0.74	NA
Pesticides	12674-11-2	PCB-1016 (AROCHLOR 1016)	0	7	ND	ND	ND	21	NA
Pesticides	12789-03-6	GAMMA-CHLORDANE	6	26	ND	0.0011	0.019	NA	NA
Pesticides	309-00-2	ALDRIN	4	26	ND	0.0015	0.036	0.1	0.3
Pesticides	319-84-6	ALPHA BHC	1	26	ND	0.000058	0.0015	0.36	0.9
Pesticides	319-85-7	BETA BHC	3	26	ND	0.0018	0.035	1.3	NA
Pesticides	319-86-8	DELTA BHC	1	26	ND	0.00012	0.0031	NA	NA
Pesticides	33213-65-9	BETA ENDOSULFAN	2	26	ND	0.00048	0.0087	NA	NA
Pesticides	50-29-3	P,P'-DDT	4	26	ND	0.0022	0.029	7	NA
Pesticides	5103-71-9	ALPHA-CHLORDANE	4	26	ND	0.0009	0.021	NA	NA
Pesticides	53469-21-9	PCB-1242 (AROCHLOR 1242)	1	16	ND	0.0063	0.1	0.74	NA
Pesticides	53494-70-5	ENDRIN KETONE	4	26	ND	0.0035	0.05	NA	NA
Pesticides	58-89-9	GAMMA BHC (LINDANE)	0	17	ND	ND	ND	1.7	NA
Pesticides	60-57-1	DIELDRIN	3	26	ND	0.00089	0.02	0.11	0.4
Pesticides	72-20-8	ENDRIN	6	26	ND	0.0046	0.076	180	60
Pesticides	72-43-5	METHOXYCHLOR	1	26	ND	0.000046	0.0012	3100	1000
Pesticides	72-54-8	P,P'-DDD	4	26	ND	0.002	0.037	10	NA
Pesticides	72-55-9	P,P'-DDE	4	26	ND	0.0011	0.016	7	NA
Pesticides	7421-93-4	ENDRIN ALDEHYDE	0	26	ND	ND	ND	NA	NA
Pesticides	76-44-8	HEPTACHLOR	0	17	ND	ND	ND	0.38	1
Pesticides	8001-35-2	TOXAPHENE	2	26	ND	0.04	0.81	1.6	5.2
Pesticides	959-98-8	ALPHA ENDOSULFAN	2	26	ND	0.00051	0.012	NA	NA
pH	PH	PH	3	3	6.93	7.6	8.02	NA	NA
SVOCs	100-01-6	4-NITROANILINE	0	15	ND	ND	ND	82	NA
SVOCs	100-02-7	4-NITROPHENOL	0	15	ND	ND	ND	NA	NA
SVOCs	100-52-7	BENZALDEHYDE	0	8	ND	ND	ND	62000	NA
SVOCs	101-55-3	4-BROMOPHENYL PHENYL ETHER	0	15	ND	ND	ND	NA	NA
SVOCs	105-60-2	CAPROLACTAM	0	8	ND	ND	ND	100000	NA
SVOCs	105-67-9	2,4-DIMETHYLPHENOL	0	15	ND	ND	ND	12000	41000
SVOCs	106-44-5	4-METHYLPHENOL (P-CRESOL)	1	15	ND	0.0014	0.021	3100	NA
SVOCs	106-46-7	1,4-DICHLOROBENZENE	0	7	ND	ND	ND	7.9	340
SVOCs	106-47-8	4-CHLOROANILINE	0	15	ND	ND	ND	2500	820
SVOCs	108-60-1	BIS(2-CHLOROISOPROPYL) ETHER	0	15	ND	ND	ND	7.4	NA
SVOCs	108-95-2	PHENOL	0	15	ND	ND	ND	100000	61000
SVOCs	111-44-4	BIS(2-CHLOROETHYL) ETHER	0	15	ND	ND	ND	0.58	NA
SVOCs	111-91-1	BIS(2-CHLOROETHOXY) METHANE	0	15	ND	ND	ND	NA	NA
SVOCs	117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	6	15	ND	0.082	0.6	120	NA
SVOCs	117-84-0	DI-N-OCTYLPHTHALATE	0	15	ND	ND	ND	25000	NA

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Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Analysis Method	CAS #	Parameter	# of Detections	# of Samples	Minimum Result (mg/kg)	Average Result (mg/kg)	Maximum Result (mg/kg)	Region 9 Industrial Soil PRG	IEPA Class II TACO
SVOCs	118-74-1	HEXACHLOROBENZENE	1	24	ND	0.3	7.3	1.1	1.8
SVOCs	120-12-7	ANTHRACENE	4	19	ND	0.02	0.13	100000	610000
SVOCs	120-82-1	1,2,4-TRICHLOROBENZENE	0	7	ND	ND	ND	220	920
SVOCs	120-83-2	2,4-DICHLOROPHENOL	0	15	ND	ND	ND	1800	610
SVOCs	121-14-2	2,4-DINITROTOLUENE	0	15	ND	ND	ND	1200	8.4
SVOCs	129-00-0	PYRENE	15	28	ND	0.38	4	29000	61000
SVOCs	131-11-3	DIMETHYL PHTHALATE	0	15	ND	ND	ND	100000	NA
SVOCs	132-64-9	DIBENZOFURAN	4	24	ND	0.082	1.5	1600	NA
SVOCs	1912-24-9	ATRAZINE	0	8	ND	ND	ND	7.8	7100
SVOCs	191-24-2	BENZO(G,H,I)PERYLENE	5	19	ND	0.065	0.76	NA	NA
SVOCs	193-39-5	INDENO(1,2,3-C,D)PYRENE	6	19	ND	0.073	0.69	2.1	NA
SVOCs	205-99-2	BENZO(B)FLUORANTHENE	10	28	ND	0.24	2.9	2.1	8
SVOCs	206-44-0	FLUORANTHENE	13	28	ND	0.42	3.9	22000	82000
SVOCs	207-08-9	BENZO(K)FLUORANTHENE	8	19	ND	0.11	0.94	21	NA
SVOCs	208-96-8	ACENAPHTHYLENE	1	19	ND	0.0032	0.06	NA	NA
SVOCs	218-01-9	CHRYSENE	11	28	ND	0.22	2.4	210	780
SVOCs	50-32-8	BENZO(A)PYRENE	8	28	ND	0.12	1.2	0.21	0.8
SVOCs	51-28-5	2,4-DINITROPHENOL	0	15	ND	ND	ND	1200	410
SVOCs	534-52-1	4,6-DINITRO-2-METHYLPHENOL	0	15	ND	ND	ND	62	NA
SVOCs	53-70-3	DIBENZ(A,H)ANTHRACENE	4	19	ND	0.023	0.2	0.21	0.8
SVOCs	541-73-1	1,3-DICHLOROBENZENE	0	7	ND	ND	ND	600	NA
SVOCs	56-55-3	BENZO(A)ANTHRACENE	8	28	ND	0.16	2.1	2.1	8
SVOCs	59-50-7	4-CHLORO-3-METHYLPHENOL	0	15	ND	ND	ND	NA	NA
SVOCs	606-20-2	2,6-DINITROTOLUENE	0	15	ND	ND	ND	620	8.4
SVOCs	621-64-7	N-NITROSODI-N-PROPYLAMINE	0	15	ND	ND	ND	0.25	NA
SVOCs	67-72-1	HEXACHLOROETHANE	0	15	ND	ND	ND	120	2000
SVOCs	7005-72-3	4-CHLOROPHENYL PHENYL ETHER	0	15	ND	ND	ND	NA	NA
SVOCs	77-47-4	HEXACHLOROCCYCLOPENTADIENE	0	15	ND	ND	ND	3700	1.1
SVOCs	78-59-1	ISOPHORONE	0	15	ND	ND	ND	510	4600
SVOCs	83-32-9	ACENAPHTHENE	1	19	ND	0.0013	0.025	29000	120000
SVOCs	84-66-2	DIETHYL PHTHALATE	0	15	ND	ND	ND	100000	NA
SVOCs	84-74-2	DI-N-BUTYL PHTHALATE	2	15	ND	0.011	0.097	62000	NA
SVOCs	85-01-8	PHENANTHRENE	13	28	ND	0.4	5.4	NA	NA
SVOCs	85-68-7	BENZYL BUTYL PHTHALATE	0	15	ND	ND	ND	100000	NA
SVOCs	86-30-6	N-NITROSODIPHENYLAMINE	0	15	ND	ND	ND	350	NA
SVOCs	86-73-7	FLUORENE	1	19	ND	0.0019	0.037	26000	82000
SVOCs	86-74-8	CARBAZOLE	3	15	ND	0.014	0.088	86	290
SVOCs	87-68-3	HEXACHLOROBUTADIENE	0	15	ND	ND	ND	22	NA
SVOCs	87-86-5	PENTACHLOROPHENOL	1	24	ND	1.5	36	9	24
SVOCs	88-06-2	2,4,6-TRICHLOROPHENOL	0	15	ND	ND	ND	62	390
SVOCs	88-74-4	2-NITROANILINE	0	15	ND	ND	ND	1800	NA
SVOCs	88-75-5	2-NITROPHENOL	0	15	ND	ND	ND	NA	NA
SVOCs	91-20-3	NAPHTHALENE	5	28	ND	0.086	1.5	190	1.8
SVOCs	91-57-6	2-METHYLNAPHTHALENE	4	24	ND	0.19	3.4	NA	NA
SVOCs	91-58-7	2-CHLORONAPHTHALENE	0	15	ND	ND	ND	23000	NA
SVOCs	91-94-1	3,3'-DICHLOROBENZIDINE	0	15	ND	ND	ND	3.8	13
SVOCs	92-52-4	BIPHENYL (DIPHENYL)	1	8	ND	0.013	0.1	23000	NA
SVOCs	95-48-7	2-METHYLPHENOL (O-CRESOL)	0	15	ND	ND	ND	31000	100000
SVOCs	95-50-1	1,2-DICHLOROBENZENE	0	7	ND	ND	ND	600	310
SVOCs	95-57-8	2-CHLOROPHENOL	0	15	ND	ND	ND	240	10000
SVOCs	95-93-4	2,4,5-TRICHLOROPHENOL	0	15	ND	ND	ND	62000	200000
SVOCs	98-86-2	ACETOPHENONE	0	8	ND	ND	ND	NA	NA
SVOCs	98-95-3	NITROBENZENE	0	15	ND	ND	ND	100	9.4
SVOCs	99-09-2	3-NITROANILINE	0	15	ND	ND	ND	82	NA
Total Solids	TSOLIDS	TOTAL SOLIDS	29	29	60.5	82.4	94.7	NA	NA
VOCs	100-41-4	ETHYLBENZENE	8	33	ND	0.00095	0.013	400	NA
VOCs	100-42-5	STYRENE	1	20	ND	0.00065	0.013	1700	430
VOCs	10061-01-5	CIS-1,3-DICHLOROPROPENE	2	20	ND	0.00075	0.013	NA	NA
VOCs	10061-02-6	TRANS-1,3-DICHLOROPROPENE	1	20	ND	0.00065	0.013	NA	NA
VOCs	106-46-7	1,4-DICHLOROBENZENE	0	13	ND	ND	ND	7.9	340
VOCs	106-93-4	1,2-DIBROMOETHANE	0	13	ND	ND	ND	0.073	0.12
VOCs	107-06-2	1,2-DICHLOROETHANE	1	20	ND	0.00065	0.013	0.6	0.7
VOCs	108-10-1	METHYL ISOBUTYL KETONE	2	20	ND	0.0015	0.017	47000	NA
VOCs	108-87-2	METHYLCYCLOHEXANE	9	13	ND	0.0041	0.017	8700	NA
VOCs	108-88-3	TOLUENE	14	33	ND	0.0017	0.013	520	42
VOCs	108-90-7	CHLOROBENZENE	1	20	ND	0.00065	0.013	530	1.3
VOCs	110-82-7	CYCLOHEXANE	9	13	ND	0.0024	0.0067	140	NA
VOCs	120-82-1	1,2,4-TRICHLOROBENZENE	0	13	ND	ND	ND	220	920
VOCs	124-48-1	DIBROMOCHLOROMETHANE	1	20	ND	0.00065	0.013	2.6	NA
VOCs	127-18-4	TETRACHLOROETHYLENE(PCE)	2	20	ND	0.0007	0.013	1.3	NA
VOCs	136-59-2	CIS-1,2-DICHLOROETHYLENE	0	13	ND	ND	ND	150	NA
VOCs	136-60-5	TRANS-1,2-DICHLOROETHYLENE	0	13	ND	ND	ND	230	NA
VOCs	1634-04-4	TERT-BUTYL METHYL ETHER	0	13	ND	ND	ND	70	140
VOCs	540-59-0	DICHLOROETHYLENES	2	7	ND	0.0023	0.013	NA	NA
VOCs	541-73-1	1,3-DICHLOROBENZENE	0	13	ND	ND	ND	600	NA
VOCs	56-23-5	CARBON TETRACHLORIDE	1	20	ND	0.00065	0.013	0.55	0.64
VOCs	591-78-6	2-HEXANONE	2	20	ND	0.0018	0.022	NA	NA
VOCs	67-64-1	ACETONE	12	29	ND	0.034	0.53	54000	100000
VOCs	67-66-3	CHLOROFORM	2	20	ND	0.00075	0.013	0.47	0.54
VOCs	71-43-2	BENZENE	7	24	ND	0.00099	0.013	1.4	1.6

Table 1. Summary Statistics for Shallow Soil (0-10' BGS) Sampling Results
Remedial Investigation/Feasibility Study
Matthiessen and Hegeler Zinc Company Site, OUI
LaSalle, Illinois

Analysis Method	CAS #	Parameter	# of Detections	# of Samples	Minimum Result (mg/kg)	Average Result (mg/kg)	Maximum Result (mg/kg)	Region 9 Industrial Soil PRG	IEPA Class II TACO
VOCs	71-55-6	1,1,1-TRICHLOROETHANE	4	29	ND	0.0021	0.035	1200	1200
VOCs	74-83-9	BROMOMETHANE	1	20	ND	0.00065	0.013	13	NA
VOCs	74-87-3	CHLOROMETHANE	1	20	ND	0.00065	0.013	160	NA
VOCs	75-00-3	CHLOROETHANE	1	20	ND	0.00065	0.013	6.5	NA
VOCs	75-01-4	VINYL CHLORIDE	1	20	ND	0.00065	0.013	0.75	1.1
VOCs	75-09-2	METHYLENE CHLORIDE	12	29	ND	0.009	0.13	21	NA
VOCs	75-15-0	CARBON DISULFIDE	5	20	ND	0.004	0.049	720	9
VOCs	75-25-2	BROMOFORM	1	20	ND	0.00065	0.013	220	100
VOCs	75-27-4	BROMODICHLOROMETHANE	1	20	ND	0.00065	0.013	1.8	NA
VOCs	75-34-3	1,1-DICHLOROETHANE	1	20	ND	0.00065	0.013	1700	130
VOCs	75-35-4	1,1-DICHLOROETHENE	1	20	ND	0.00065	0.013	410	NA
VOCs	75-69-4	TRICHLOROFLUOROMETHANE	0	13	ND	ND	ND	2000	NA
VOCs	75-71-8	DICHLORODIFLUOROMETHANE	0	13	ND	ND	ND	310	NA
VOCs	76-13-1	1,1,2-TRICHLORO-1,2,2- TRIFLUOROETHANE	0	13	ND	ND	ND	5600	NA
VOCs	78-87-5	1,2-DICHLOROPROPANE	1	20	ND	0.00065	0.013	0.74	0.5
VOCs	78-93-3	METHYL ETHYL KETONE	14	29	ND	0.0095	0.12	110000	NA
VOCs	79-00-5	1,1,2-TRICHLOROETHANE	1	20	ND	0.00065	0.013	1.6	1800
VOCs	79-01-6	TRICHLOROETHYLENE (TCE)	1	20	ND	0.00065	0.013	0.11	NA
VOCs	79-20-9	METHYL ACETATE	1	13	ND	0.00014	0.0018	92000	NA
VOCs	79-34-5	1,1,2,2-TETRACHLOROETHANE	1	20	ND	0.00065	0.013	0.93	NA
VOCs	95-47-6	O-XYLENE (1,2-DIMETHYLBENZENE)	2	13	ND	0.00023	0.0019	NA	6.5
VOCs	95-50-1	1,2-DICHLOROBENZENE	0	13	ND	ND	ND	600	310
VOCs	96-12-8	1,2-DIBROMO-3-CHLOROPROPANE	0	13	ND	ND	ND	2	0.11
VOCs	98-82-8	ISOPROPYLBENZENE (CUMENE)	1	13	ND	0.000034	0.00044	2000	NA
VOCs	XYLENES	XYLENES, TOTAL	6	20	ND	0.0026	0.016	420	NA
VOCs	XYLMP	M,P-XYLENE (SUM OF ISOMERS)	3	13	ND	0.00065	0.0031	NA	NA

Notes:

1. Analytical results are presented in mg/kg.
2. NA indicates not available.
3. ND indicates below detection limit; drawn from data sources where detection limits not available.
4. USEPA Region 9 Preliminary Remediation Goals (PRGs) for Soil - October, 2004.
5. Illinois EPA (IEPA) Tiered Approach to Corrective Action Objectives (TACO)
Tier 1 Soil Remediation Objectives for Industrial/Commercial Properties - February, 2007.
6. Shallow Soils are defined as 0 - 10 feet below ground surface (BGS).

Table 2. Summary Statistics for Deep Soil (>10' BGS) Sampling Results
Remedial Investigation/Feasibility Study
Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Analysis Method	CAS #	Parameter	# of Detections	# of Samples	Minimum Result (mg/kg)	Average Result (mg/kg)	Maximum Result (mg/kg)	Region 9 Industrial Soil PRG	IEPA Class II TACO
Cyanide	57-12-5	CYANIDE	0	4	ND	ND	ND	12000	4100
Metals	14808-79-8	SULFATE (AS SO ₄)	19	19	176	6960	23200	NA	NA
Metals	18496-25-8	SULFIDE	11	19	ND	65.8	547	NA	NA
Metals	3812-32-6	CARBONATE (AS CO ₃)	16	16	0.00100	21.3	302	NA	NA
Metals	57-12-5	CYANIDE	1	19	ND	0.0389	0.740	12000	4100
Metals	71-52-3	BICARBONATE	16	16	90.4	564	2610	NA	NA
Metals	7429-90-5	ALUMINUM	21	21	3130	12600	33000	100000	NA
Metals	7439-89-6	IRON	37	37	8.20	40600	209000	100000	NA
Metals	7439-92-1	LEAD	37	37	1.40	433	2640	800	700
Metals	7439-95-4	MAGNESIUM	20	21	ND	8350	66600	NA	730000
Metals	7439-96-5	MANGANESE	37	37	23.6	2730	40600	19000	4100
Metals	7439-97-6	MERCURY	18	36	ND	0.316	6.10	NA	0.1
Metals	7440-02-0	NICKEL	37	37	4.40	35.1	88.7	20000	4100
Metals	7440-09-7	POTASSIUM	21	21	157	1740	4700	NA	NA
Metals	7440-22-4	SILVER	4	21	ND	2.93	51.6	NA	1000
Metals	7440-23-5	SODIUM	21	21	140	606	1880	NA	NA
Metals	7440-28-0	THALLIUM	14	21	ND	0.170	0.565	NA	160
Metals	7440-36-0	ANTIMONY	13	21	ND	9.24	81.4	410	82
Metals	7440-38-2	ARSENIC	20	21	ND	18.9	117	1.6	61
Metals	7440-39-3	BARIUM	37	37	16.7	204	2130	67000	14000
Metals	7440-41-7	BERYLLIUM	21	21	0.229	1.51	5.90	1900	410
Metals	7440-43-9	CADMIUM	37	37	0.703	59.5	521	450	200
Metals	7440-47-3	CHROMIUM, TOTAL	37	37	1.80	20.1	97.5	450	NA
Metals	7440-48-4	COBALT	21	21	3.20	20.4	55.2	1900	12000
Metals	7440-50-8	COPPER	21	21	11.9	378	2810	41000	8200
Metals	7440-62-2	VANADIUM	21	21	11.3	25.7	42.6	1000	1400
Metals	7440-66-6	ZINC	37	37	39.4	14700	170000	100000	61000
Metals	7440-70-2	CALCIUM	21	21	1180	58500	216000	NA	NA
Metals	7782-49-2	SELENIUM	15	21	ND	1.68	5.10	5100	1000
SVOCs	100-01-6	4-NITROANILINE	0	5	ND	ND	ND	82	NA
SVOCs	100-02-7	4-NITROPHENOL	0	5	ND	ND	ND	NA	NA
SVOCs	100-52-7	BENZALDEHYDE	0	5	ND	ND	ND	62000	NA
SVOCs	101-55-3	4-BROMOPHENYL PHENYL ETHER	0	5	ND	ND	ND	NA	NA
SVOCs	105-60-2	CAPROLACTAM	0	5	ND	ND	ND	100000	NA
SVOCs	105-67-9	2,4-DIMETHYLPHENOL	0	5	ND	ND	ND	12000	41000
SVOCs	106-44-5	4-METHYLPHENOL (P-CRESOL)	0	5	ND	ND	ND	3100	NA
SVOCs	106-47-8	4-CHLOROANILINE	0	5	ND	ND	ND	2500	820
SVOCs	108-60-1	BIS(2-CHLOROISOPROPYL) ETHER	0	5	ND	ND	ND	7.4	NA
SVOCs	108-95-2	PHENOL	0	5	ND	ND	ND	100000	61000
SVOCs	111-44-4	BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	0	5	ND	ND	ND	0.58	NA
SVOCs	111-91-1	BIS(2-CHLOROETHOXY) METHANE	0	5	ND	ND	ND	NA	NA
SVOCs	117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	0	5	ND	ND	ND	120	NA
SVOCs	117-84-0	DI-N-OCTYLPHTHALATE	0	5	ND	ND	ND	25000	NA
SVOCs	118-74-1	HEXACHLOROBENZENE	0	5	ND	ND	ND	1.1	1.8
SVOCs	120-12-7	ANTHRACENE	1	7	ND	0.010	0.073	100000	610000
SVOCs	120-83-2	2,4-DICHLOROPHENOL	0	5	ND	ND	ND	1800	610
SVOCs	121-14-2	2,4-DINITROTOLUENE	0	5	ND	ND	ND	1200	8.4
SVOCs	129-00-0	PYRENE	3	7	ND	0.069	0.31	29000	61000
SVOCs	131-11-3	DIMETHYL PHTHALATE	0	5	ND	ND	ND	100000	NA
SVOCs	132-64-9	DIBENZOFURAN	0	5	ND	ND	ND	1600	NA
SVOCs	1912-24-9	ATRAZINE	0	5	ND	ND	ND	7.8	7100
SVOCs	191-24-2	BENZO(G,H,I)PERYLENE	2	7	ND	0.018	0.079	NA	NA
SVOCs	193-39-5	INDENO(1,2,3-C,D)PYRENE	2	7	ND	0.016	0.068	2.1	NA
SVOCs	205-99-2	BENZO(B)FLUORANTHENE	2	7	ND	0.022	0.093	2.1	8
SVOCs	206-44-0	FLUORANTHENE	3	7	ND	0.071	0.32	22000	82000
SVOCs	207-08-9	BENZO(K)FLUORANTHENE	2	7	ND	0.022	0.088	21	NA
SVOCs	208-96-8	ACENAPHTHYLENE	1	7	ND	0.0057	0.040	NA	NA
SVOCs	218-01-9	CHRYSENE	2	7	ND	0.031	0.14	210	780
SVOCs	50-32-8	BENZO(A)PYRENE	2	7	ND	0.027	0.11	0.21	0.8
SVOCs	51-28-5	2,4-DINITROPHENOL	0	5	ND	ND	ND	1200	410
SVOCs	534-52-1	4,6-DINITRO-2-METHYLPHENOL	0	5	ND	ND	ND	62	NA
SVOCs	53-70-3	DIBENZ(A,H)ANTHRACENE	1	7	ND	0.0037	0.026	0.21	0.8
SVOCs	56-55-3	BENZO(A)ANTHRACENE	2	7	ND	0.030	0.14	2.1	8
SVOCs	59-50-7	4-CHLORO-3-METHYLPHENOL	0	5	ND	ND	ND	NA	NA
SVOCs	606-20-2	2,6-DINITROTOLUENE	0	5	ND	ND	ND	620	8.4
SVOCs	621-64-7	N-NITROSODI-N-PROPYLAMINE	0	5	ND	ND	ND	0.25	NA
SVOCs	67-72-1	HEXACHLOROETHANE	0	5	ND	ND	ND	120	2000
SVOCs	7005-72-3	4-CHLOROPHENYL PHENYL ETHER	0	5	ND	ND	ND	NA	NA
SVOCs	77-47-4	HEXACHLORO-CYCLOPENTADIENE	0	5	ND	ND	ND	3700	1.1
SVOCs	78-59-1	ISOPHORONE	0	5	ND	ND	ND	510	4600
SVOCs	83-32-9	ACENAPHTHENE	0	7	ND	ND	ND	29000	120000
SVOCs	84-66-2	DIETHYL PHTHALATE	0	5	ND	ND	ND	100000	NA
SVOCs	84-74-2	DI-N-BUTYL PHTHALATE	1	5	ND	0.0072	0.036	62000	NA
SVOCs	85-01-8	PHENANTHRENE	2	7	ND	0.059	0.31	NA	NA
SVOCs	85-68-7	BENZYL BUTYL PHTHALATE	0	5	ND	ND	ND	100000	NA
SVOCs	86-30-6	N-NITROSODIPHENYLAMINE	0	5	ND	ND	ND	350	NA
SVOCs	86-73-7	FLUORENE	0	7	ND	ND	ND	26000	82000
SVOCs	86-74-8	CARBAZOLE	0	5	ND	ND	ND	86	290
SVOCs	87-68-3	HEXACHLORO-BUTADIENE	0	5	ND	ND	ND	22	NA

Table 2. Summary Statistics for Deep Soil (>10' BGS) Sampling Results
Remedial Investigation/Feasibility Study
Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Analysis Method	CAS #	Parameter	# of Detections	# of Samples	Minimum Result (mg/kg)	Average Result (mg/kg)	Maximum Result (mg/kg)	Region 9 Industrial Soil PRG	IEPA Class II TACO
SVOCs	87-86-5	PENTACHLOROPHENOL	0	5	ND	ND	ND	9	24
SVOCs	88-06-2	2,4,6-TRICHLOROPHENOL	0	5	ND	ND	ND	62	390
SVOCs	88-74-4	2-NITROANILINE	0	5	ND	ND	ND	1800	NA
SVOCs	88-75-5	2-NITROPHENOL	0	5	ND	ND	ND	NA	NA
SVOCs	91-20-3	NAPHTHALENE	0	7	ND	ND	ND	190	1.8
SVOCs	91-57-6	2-METHYLNAPHTHALENE	0	5	ND	ND	ND	NA	NA
SVOCs	91-58-7	2-CHLORONAPHTHALENE	0	5	ND	ND	ND	23000	NA
SVOCs	91-94-1	3,3'-DICHLOROBENZIDINE	0	5	ND	ND	ND	3.8	13
SVOCs	92-52-4	BIPHENYL (DIPHENYL)	0	5	ND	ND	ND	23000	NA
SVOCs	95-48-7	2-METHYLPHENOL (O-CRESOL)	0	5	ND	ND	ND	31000	100000
SVOCs	95-57-8	2-CHLOROPHENOL	0	5	ND	ND	ND	240	10000
SVOCs	95-95-4	2,4,5-TRICHLOROPHENOL	0	5	ND	ND	ND	62000	200000
SVOCs	98-86-2	ACETOPHENONE	0	5	ND	ND	ND	NA	NA
SVOCs	98-95-3	NITROBENZENE	0	5	ND	ND	ND	100	9.4
SVOCs	99-09-2	3-NITROANILINE	0	5	ND	ND	ND	82	NA
Total Solids	TSOLIDS	TOTAL SOLIDS	18	18	74.3	84.0	91.8	NA	NA
VOCs	100-41-4	ETHYLBENZENE	5	7	ND	0.023	0.14	400	NA
VOCs	100-42-5	STYRENE	0	5	ND	ND	ND	1700	430
VOCs	10061-01-5	CIS-1,3-DICHLOROPROPENE	0	5	ND	ND	ND	NA	NA
VOCs	10061-02-6	TRANS-1,3-DICHLOROPROPENE	0	5	ND	ND	ND	NA	NA
VOCs	106-46-7	1,4-DICHLOROBENZENE	0	5	ND	ND	ND	7.9	340
VOCs	106-93-4	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0	5	ND	ND	ND	0.073	0.12
VOCs	107-06-2	1,2-DICHLOROETHANE	0	5	ND	ND	ND	0.6	0.7
VOCs	108-10-1	METHYL ISOBUTYL KETONE (4-METHYL-2 PENTANONE)	0	5	ND	ND	ND	47000	NA
VOCs	108-87-2	METHYLCYCLOHEXANE	5	5	0.0015	0.0025	0.0040	8700	NA
VOCs	108-88-3	TOLUENE	4	7	ND	0.0015	0.0044	520	42
VOCs	108-90-7	CHLOROBENZENE	0	5	ND	ND	ND	530	1.3
VOCs	110-82-7	CYCLOHEXANE	5	5	0.00083	0.0020	0.0031	140	NA
VOCs	120-82-1	1,2,4-TRICHLOROBENZENE	0	5	ND	ND	ND	220	920
VOCs	124-48-1	DIBROMOCHLOROMETHANE	0	5	ND	ND	ND	2.6	NA
VOCs	127-18-4	TETRACHLOROETHYLENE(PCE)	0	5	ND	ND	ND	1.3	NA
VOCs	156-59-2	CIS-1,2-DICHLOROETHYLENE	0	5	ND	ND	ND	150	NA
VOCs	156-60-5	TRANS-1,2-DICHLOROETHENE	0	5	ND	ND	ND	230	NA
VOCs	1634-04-4	TERT-BUTYL METHYL ETHER	0	5	ND	ND	ND	70	140
VOCs	541-73-1	1,3-DICHLOROBENZENE	0	5	ND	ND	ND	600	NA
VOCs	56-23-5	CARBON TETRACHLORIDE	0	5	ND	ND	ND	0.55	0.64
VOCs	591-78-6	2-HEXANONE	0	5	ND	ND	ND	NA	NA
VOCs	67-64-1	ACETONE	5	5	0.020	0.061	0.19	54000	100000
VOCs	67-66-3	CHLOROFORM	0	5	ND	ND	ND	0.47	0.54
VOCs	71-43-2	BENZENE	5	7	ND	0.0016	0.0046	1.4	1.6
VOCs	71-55-6	1,1,1-TRICHLOROETHANE	0	5	ND	ND	ND	1200	1200
VOCs	74-83-9	BROMOMETHANE	0	5	ND	ND	ND	13	NA
VOCs	74-87-3	CHLOROMETHANE	0	5	ND	ND	ND	160	NA
VOCs	75-00-3	CHLOROETHANE	0	5	ND	ND	ND	6.5	NA
VOCs	75-01-4	VINYL CHLORIDE	0	5	ND	ND	ND	0.75	1.1
VOCs	75-09-2	METHYLENE CHLORIDE	5	5	0.00037	0.00054	0.00085	21	NA
VOCs	75-15-0	CARBON DISULFIDE	4	5	ND	0.019	0.047	720	9
VOCs	75-25-2	BROMOFORM	0	5	ND	ND	ND	220	100
VOCs	75-27-4	BROMODICHLOROMETHANE	0	5	ND	ND	ND	1.8	NA
VOCs	75-34-3	1,1-DICHLOROETHANE	0	5	ND	ND	ND	1700	130
VOCs	75-35-4	1,1-DICHLOROETHENE	0	5	ND	ND	ND	410	NA
VOCs	75-69-4	TRICHLOROFLUOROMETHANE	0	5	ND	ND	ND	2000	NA
VOCs	75-71-8	DICHLORODIFLUOROMETHANE	0	5	ND	ND	ND	310	NA
VOCs	76-13-1	1,1,2-TRICHLORO-1,2,2- TRIFLUOROETHANE	0	5	ND	ND	ND	5600	NA
VOCs	78-87-5	1,2-DICHLOROPROPANE	0	5	ND	ND	ND	0.74	0.5
VOCs	78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	4	5	ND	0.0085	0.029	110000	NA
VOCs	79-00-5	1,1,2-TRICHLOROETHANE	0	5	ND	ND	ND	1.6	1800
VOCs	79-01-6	TRICHLOROETHYLENE (TCE)	0	5	ND	ND	ND	0.11	NA
VOCs	79-20-9	METHYL ACETATE	3	5	ND	0.0012	0.0043	92000	NA
VOCs	79-34-5	1,1,2,2-TETRACHLOROETHANE	0	5	ND	ND	ND	0.93	NA
VOCs	95-47-6	O-XYLENE (1,2-DIMETHYLBENZENE)	2	5	ND	0.00033	0.00091	NA	6.5
VOCs	95-50-1	1,2-DICHLOROBENZENE	0	5	ND	ND	ND	600	310
VOCs	96-12-8	1,2-DIBROMO-3-CHLOROPROPANE	0	5	ND	ND	ND	2	0.11
VOCs	98-82-8	ISOPROPYLBENZENE (CUMENE)	0	5	ND	ND	ND	2000	NA
VOCs	XYLENES	XYLENES, TOTAL	2	2	0.041	0.17	0.30	420	NA
VOCs	XYLMP	M.P.-XYLENE (SUM OF ISOMERS)	2	5	ND	0.00066	0.0018	NA	NA

Notes:

1. Analytical results are presented in mg/kg.
2. NA indicates not available.
3. ND indicates below detection limit; drawn from data sources where detection limits not available.
4. USEPA Region 9 Preliminary Remediation Goals (PRGs) for Soil - October, 2004.
5. Illinois EPA (IEPA) Tiered Approach to Corrective Action Objectives (TACO)
Tier 1 Soil Remediation Objectives for Industrial/Commercial Properties - February, 2007.
6. Deep Soils are defined as greater than 10 feet below ground surface (BGS).

Table 3. Summary Statistics for Surface Water Sampling Results
Remedial Investigation/Feasibility Study
Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Analysis Method	CAS #	Parameter	# of Detections	# of Samples	Minimum Result (mg/L)	Average Result (mg/L)	Maximum Result (mg/L)	Region 5 ECO SL (mg/L)
Cyanide	57-12-5	CYANIDE	0	5	ND	ND	ND	0.0052
Metals	14808-79-8	SULFATE (AS SO4)	3	3	37.1	38.7	40.4	NA
Metals	18496-25-8	SULFIDE	0	3	ND	ND	ND	NA
Metals	3812-32-6	CARBONATE (AS CO3)	3	3	3.04	3.09	3.19	NA
Metals	57-12-5	CYANIDE	2	3	ND	0.00607	0.0100	0.0052
Metals	71-52-3	BICARBONATE	3	3	246	248	251	NA
Metals	7429-90-5	ALUMINUM	8	8	0.223	1.64	5.05	NA
Metals	7439-89-6	IRON	11	11	0.271	1.46	3.43	NA
Metals	7439-92-1	LEAD	11	11	0.000252	0.00172	0.00760	0.0012
Metals	7439-95-4	MAGNESIUM	8	8	38.8	40.1	42.6	NA
Metals	7439-96-5	MANGANESE	11	11	0.0203	0.172	1.24	NA
Metals	7439-97-6	MERCURY	4	11	ND	0.0000412	0.000220	0.0000013
Metals	7440-02-0	NICKEL	8	11	ND	0.00448	0.00870	0.029
Metals	7440-09-7	POTASSIUM	8	8	3.98	4.95	5.86	NA
Metals	7440-22-4	SILVER	0	8	ND	ND	ND	0.00012
Metals	7440-23-5	SODIUM	8	8	44.7	47.8	53.5	NA
Metals	7440-28-0	THALLIUM	2	8	ND	0.0000134	0.0000640	0.01
Metals	7440-36-0	ANTIMONY	0	8	ND	ND	ND	0.08
Metals	7440-38-2	ARSENIC	8	8	0.000341	0.000709	0.00150	0.15
Metals	7440-39-3	BARIUM	11	11	0.0762	0.0890	0.115	0.22
Metals	7440-41-7	BERYLLIUM	1	8	ND	0.0000149	0.000119	0.0036
Metals	7440-43-9	CADMIUM	3	11	ND	0.00127	0.00710	0.00015
Metals	7440-47-3	CHROMIUM, TOTAL	8	11	ND	0.00170	0.00500	0.042
Metals	7440-48-4	COBALT	8	8	0.000421	0.000979	0.00150	0.024
Metals	7440-50-8	COPPER	8	8	0.00150	0.00233	0.00380	0.0016
Metals	7440-62-2	VANADIUM	5	8	ND	0.00117	0.00430	0.012
Metals	7440-66-6	ZINC	11	11	0.00470	0.369	1.96	0.066
Metals	7440-70-2	CALCIUM	8	8	75.5	83.2	89.2	NA
Metals	7782-49-2	SELENIUM	8	8	0.000659	0.000957	0.00140	0.005
Metals	TSS	Total Suspended Solids	3	3	29.6	65.8	102	NA
PCBs	11096-82-5	PCB-1260 (AROCHLOR 1260)	0	5	ND	ND	ND	0.00000012
PCBs	11097-69-1	PCB-1254 (AROCHLOR 1254)	0	5	ND	ND	ND	0.00000012
PCBs	11104-28-2	PCB-1221 (AROCHLOR 1221)	0	5	ND	ND	ND	0.00000012
PCBs	11141-16-5	PCB-1232 (AROCHLOR 1232)	0	5	ND	ND	ND	0.00000012
PCBs	12672-29-6	PCB-1248 (AROCHLOR 1248)	0	5	ND	ND	ND	0.00000012
PCBs	12674-11-2	PCB-1016 (AROCHLOR 1016)	0	5	ND	ND	ND	0.00000012
PCBs	53469-21-9	PCB-1242 (AROCHLOR 1242)	0	5	ND	ND	ND	0.00000012
Pesticides	1024-57-3	HEPTACHLOR EPOXIDE	0	6	ND	ND	ND	0.0000038
Pesticides	1031-07-8	ENDOSULFAN SULFATE	0	6	ND	ND	ND	0.0022
Pesticides	12789-03-6	GAMMA-CHLORDANE	0	6	ND	ND	ND	NA
Pesticides	309-00-2	ALDRIN	0	6	ND	ND	ND	0.000017
Pesticides	319-84-6	ALPHA BHC (ALPHA)	0	6	ND	ND	ND	0.012
Pesticides	319-85-7	BETA BHC (BETA)	0	6	ND	ND	ND	0.0005
Pesticides	319-86-8	DELTA BHC (DELTA)	0	6	ND	ND	ND	0.67
Pesticides	33213-65-9	BETA ENDOSULFAN	0	6	ND	ND	ND	0.000056
Pesticides	50-29-3	P,P'-DDT	0	6	ND	ND	ND	0.000000011
Pesticides	5103-71-9	ALPHA-CHLORDANE	0	6	ND	ND	ND	NA
Pesticides	53494-70-5	ENDRIN KETONE	0	6	ND	ND	ND	NA
Pesticides	58-89-9	GAMMA BHC (LINDANE)	0	6	ND	ND	ND	0.000026
Pesticides	60-57-1	DELDRIN	0	6	ND	ND	ND	0.000000071
Pesticides	72-20-8	ENDRIN	0	6	ND	ND	ND	0.000036
Pesticides	72-43-5	METHOXYCHLOR	0	6	ND	ND	ND	0.000019
Pesticides	72-54-8	P,P'-DDD	0	6	ND	ND	ND	NA
Pesticides	72-55-9	P,P'-DDE	0	6	ND	ND	ND	4.5E-12
Pesticides	7421-93-4	ENDRIN ALDEHYDE	0	6	ND	ND	ND	0.00015
Pesticides	76-44-8	HEPTACHLOR	0	6	ND	ND	ND	0.0000038
Pesticides	8001-35-2	TOXAPHENE	0	6	ND	ND	ND	0.00000014
Pesticides	959-98-8	ALPHA ENDOSULFAN	0	6	ND	ND	ND	0.000056
SVOCs	100-01-6	4-NITROANILINE	0	5	ND	ND	ND	NA
SVOCs	100-02-7	4-NITROPHENOL	0	5	ND	ND	ND	0.06
SVOCs	100-52-7	BENZALDEHYDE	0	5	ND	ND	ND	NA
SVOCs	101-55-3	4-BROMOPHENYL PHENYL ETHER	0	5	ND	ND	ND	0.0015
SVOCs	105-60-2	CAPROLACTAM	0	5	ND	ND	ND	NA
SVOCs	105-67-9	2,4-DIMETHYLPHENOL	0	5	ND	ND	ND	0.1
SVOCs	106-44-5	4-METHYLPHENOL (P-CRESOL)	0	5	ND	ND	ND	0.023
SVOCs	106-47-8	4-CHLOROANILINE	0	5	ND	ND	ND	0.23
SVOCs	108-60-1	BIS(2-CHLOROISOPROPYL) ETHER	0	5	ND	ND	ND	NA
SVOCs	108-95-2	PHENOL	0	5	ND	ND	ND	0.18
SVOCs	111-44-4	BIS(2-CHLOROETHYL) ETHER (2-	0	5	ND	ND	ND	.19
SVOCs	111-91-1	BIS(2-CHLOROETHOXY) METHANE	0	5	ND	ND	ND	NA
SVOCs	117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	0	5	ND	ND	ND	0.0003
SVOCs	117-84-0	DIN-OCTYL PHTHALATE	0	5	ND	ND	ND	0.03
SVOCs	118-74-1	HEXACHLOROBENZENE	0	5	ND	ND	ND	0.0000003
SVOCs	120-12-7	ANTHRACENE	0	5	ND	ND	ND	0.000035
SVOCs	120-83-2	2,4-DICHLOROPHENOL	0	5	ND	ND	ND	0.011
SVOCs	121-14-2	2,4-DINITROTOLUENE	0	5	ND	ND	ND	0.044
SVOCs	129-00-0	PYRENE	0	5	ND	ND	ND	0.0003
SVOCs	131-11-3	DIMETHYL PHTHALATE	0	5	ND	ND	ND	NA
SVOCs	132-64-9	DIBENZOFURAN	0	5	ND	ND	ND	0.004
SVOCs	1912-24-9	ATRAZINE	0	5	ND	ND	ND	NA
SVOCs	191-24-2	BENZO(G,H)PERYLENE	0	5	ND	ND	ND	0.0076
SVOCs	193-39-5	INDENO(1,2,3-C,D)PYRENE	0	5	ND	ND	ND	0.0043
SVOCs	205-99-2	BENZO(B)FLUORANTHENE	0	5	ND	ND	ND	0.0091
SVOCs	206-44-0	FLUORANTHENE	0	5	ND	ND	ND	0.0019
SVOCs	207-08-9	BENZO(K)FLUORANTHENE	0	5	ND	ND	ND	NA
SVOCs	208-96-8	ACENAPHTHYLENE	0	5	ND	ND	ND	4.8
SVOCs	218-01-9	CHRYSENE	0	5	ND	ND	ND	NA
SVOCs	50-32-8	BENZO(A)PYRENE	0	5	ND	ND	ND	0.000014
SVOCs	51-28-5	2,4-DINITROPHENOL	0	5	ND	ND	ND	0.019
SVOCs	534-52-1	4,6-DINITRO-2-METHYLPHENOL	0	5	ND	ND	ND	0.023
SVOCs	53-70-3	DIBENZO(A,H)ANTHRACENE	0	5	ND	ND	ND	NA

Table 3. Summary Statistics for Surface Water Sampling Results
Remedial Investigation/Feasibility Study
Matthiessen and Hegeler Zinc Company Site, OUI
LaSalle, Illinois

Analysis Method	CAS #	Parameter	# of Detections	# of Samples	Minimum Result (mg/L)	Average Result (mg/L)	Maximum Result (mg/L)	Region 5 ECO SL (mg/L)
Cyanide	57-12-5	CYANIDE	0	5	ND	ND	ND	0.0052
Metals	14808-79-8	SULFATE (AS SO4)	3	3	37.1	38.7	40.4	NA
Metals	18496-25-8	SULFIDE	0	3	ND	ND	ND	NA
SVOCs	56-55-3	BENZO(A)ANTHRACENE	0	5	ND	ND	ND	0.000025
SVOCs	59-50-7	4-CHLORO-3-METHYLPHENOL	0	5	ND	ND	ND	0.035
SVOCs	606-20-2	2,6-DINITROTOLUENE	0	5	ND	ND	ND	0.081
SVOCs	621-64-7	N-NITROSODI-N-PROPYLAMINE	0	5	ND	ND	ND	NA
SVOCs	67-72-1	HEXACHLOROETHANE	0	5	ND	ND	ND	0.008
SVOCs	7005-72-3	4-CHLOROPHENYL PHENYL ETHER	0	5	ND	ND	ND	NA
SVOCs	77-47-4	HEXACHLOROCYCLOPENTADIENE	0	5	ND	ND	ND	0.077
SVOCs	78-59-1	ISOPHORONE	0	5	ND	ND	ND	0.92
SVOCs	83-32-9	ACENAPHTHENE	0	5	ND	ND	ND	0.038
SVOCs	84-66-2	DIETHYL PHTHALATE	0	5	ND	ND	ND	0.11
SVOCs	84-74-2	DI-N-BUTYL PHTHALATE	0	5	ND	ND	ND	0.0097
SVOCs	85-01-8	PHENANTHRENE	0	5	ND	ND	ND	0.0036
SVOCs	85-68-7	BENZYL BUTYL PHTHALATE	0	5	ND	ND	ND	0.023
SVOCs	86-30-6	N-NITROSODIPHENYLAMINE	0	5	ND	ND	ND	NA
SVOCs	86-73-7	FLUORENE	0	5	ND	ND	ND	0.019
SVOCs	86-74-8	CARBAZOLE	0	5	ND	ND	ND	NA
SVOCs	87-68-3	HEXACHLOROBUTADIENE	0	5	ND	ND	ND	0.000053
SVOCs	87-86-5	PENTACHLOROPHENOL	0	5	ND	ND	ND	0.004
SVOCs	88-06-2	2,4,6-TRICHLOROPHENOL	0	5	ND	ND	ND	0.0049
SVOCs	88-74-4	2-NITROANILINE	0	5	ND	ND	ND	NA
SVOCs	88-75-5	2-NITROPHENOL	0	5	ND	ND	ND	NA
SVOCs	91-20-3	NAPHTHALENE	0	5	ND	ND	ND	0.013
SVOCs	91-57-6	2-METHYLNAPHTHALENE	0	5	ND	ND	ND	0.33
SVOCs	91-58-7	2-CHLORONAPHTHALENE	0	5	ND	ND	ND	0.0004
SVOCs	91-94-1	3,3'-DICHLOBENZIDINE	0	5	ND	ND	ND	0.0045
SVOCs	92-52-4	BIPHENYL (DIPHENYL)	0	5	ND	ND	ND	NA
SVOCs	93-48-7	2-METHYLPHENOL (O-CRESOL)	0	5	ND	ND	ND	0.067
SVOCs	95-57-8	2-CHLOROPHENOL	0	5	ND	ND	ND	0.024
SVOCs	95-95-4	2,4,5-TRICHLOROPHENOL	0	5	ND	ND	ND	NA
SVOCs	98-86-2	ACETOPHENONE	0	5	ND	ND	ND	NA
SVOCs	98-95-3	NITROBENZENE	0	5	ND	ND	ND	0.22
SVOCs	99-09-2	3-NITROANILINE	0	5	ND	ND	ND	NA
VOCs	100-41-4	ETHYLBENZENE	0	5	ND	ND	ND	0.014
VOCs	100-42-5	STYRENE	0	5	ND	ND	ND	0.032
VOCs	10061-01-5	CIS-1,3-DICHLOROPROPENE	0	5	ND	ND	ND	NA
VOCs	10061-02-6	TRANS-1,3-DICHLOROPROPENE	0	5	ND	ND	ND	NA
VOCs	106-46-7	1,4-DICHLOROBENZENE	0	5	ND	ND	ND	0.0094
VOCs	106-93-4	1,2-DIBROMOETHANE (ETHYLENE)	0	5	ND	ND	ND	NA
VOCs	107-06-2	1,2-DICHLOROETHANE	0	5	ND	ND	ND	0.91
VOCs	108-10-1	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0	5	ND	ND	ND	0.17
VOCs	108-87-2	METHYLCYCLOHEXANE	0	5	ND	ND	ND	NA
VOCs	108-88-3	TOLUENE	0	5	ND	ND	ND	0.25
VOCs	108-90-7	CHLOROBENZENE	0	5	ND	ND	ND	0.047
VOCs	110-82-7	CYCLOHEXANE	0	5	ND	ND	ND	NA
VOCs	120-82-1	1,2,4-TRICHLOROBENZENE	0	5	ND	ND	ND	0.03
VOCs	124-48-1	DIBROMOCHLOROMETHANE	0	5	ND	ND	ND	NA
VOCs	127-18-4	TETRACHLOROETHYLENE (PCE)	0	5	ND	ND	ND	0.045
VOCs	156-59-2	CIS-1,2-DICHLOROETHYLENE	0	5	ND	ND	ND	NA
VOCs	156-60-5	TRANS-1,2-DICHLOROETHYLENE	0	5	ND	ND	ND	0.97
VOCs	1634-04-4	TERT-BUTYL METHYL ETHER	0	5	ND	ND	ND	NA
VOCs	541-73-1	1,3-DICHLOROBENZENE	0	5	ND	ND	ND	0.038
VOCs	56-23-5	CARBON TETRACHLORIDE	0	5	ND	ND	ND	0.24
VOCs	591-78-6	2-HEXANONE	0	5	ND	ND	ND	0.099
VOCs	67-64-1	ACETONE	3	5	ND	0.0013	0.0027	1.7
VOCs	67-66-3	CHLOROFORM	0	5	ND	ND	ND	0.14
VOCs	71-43-2	BENZENE	0	5	ND	ND	ND	0.11
VOCs	71-55-6	1,1,1-TRICHLOROETHANE	0	5	ND	ND	ND	0.076
VOCs	74-83-9	BROMOMETHANE	0	5	ND	ND	ND	0.016
VOCs	74-87-3	CHLOROMETHANE	0	5	ND	ND	ND	NA
VOCs	75-00-3	CHLOROETHANE	0	5	ND	ND	ND	NA
VOCs	75-01-4	VINYL CHLORIDE	0	5	ND	ND	ND	0.93
VOCs	75-09-2	METHYLENE CHLORIDE	0	5	ND	ND	ND	0.94
VOCs	75-15-0	CARBON DISULFIDE	0	5	ND	ND	ND	0.015
VOCs	75-25-2	BROMOFORM	0	5	ND	ND	ND	0.23
VOCs	75-27-4	BROMODICHLOROMETHANE	0	5	ND	ND	ND	NA
VOCs	75-34-3	1,1-DICHLOROETHANE	0	5	ND	ND	ND	0.047
VOCs	75-35-4	1,1-DICHLOROETHYLENE	0	5	ND	ND	ND	0.065
VOCs	75-69-4	TRICHLOROFLUOROMETHANE	0	5	ND	ND	ND	NA
VOCs	75-71-8	DICHLORODIFLUOROMETHANE	0	5	ND	ND	ND	NA
VOCs	76-13-1	1,1,2-TRICHLORO-1,2,2,2-TETRACHLOROETHANE	0	5	ND	ND	ND	NA
VOCs	78-87-5	1,2-DICHLOROPROPANE	0	5	ND	ND	ND	0.36
VOCs	78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	0	5	ND	ND	ND	2.2
VOCs	79-00-5	1,1,2-TRICHLOROETHANE	0	5	ND	ND	ND	0.5
VOCs	79-01-6	TRICHLOROETHYLENE (TCE)	0	5	ND	ND	ND	0.047
VOCs	79-20-9	METHYL ACETATE	0	5	ND	ND	ND	NA
VOCs	79-34-5	1,1,2,2-TETRACHLOROETHANE	0	5	ND	ND	ND	0.38
VOCs	95-47-6	O-XYLENE (1,2-DIMETHYLBENZENE)	0	5	ND	ND	ND	NA
VOCs	95-50-1	1,2-DICHLOROBENZENE	0	5	ND	ND	ND	0.014
VOCs	96-12-8	1,2-DIBROMO-3-CHLOROPROPANE	0	5	ND	ND	ND	NA
VOCs	98-82-8	ISOPROPYLBENZENE (CUMENE)	0	5	ND	ND	ND	NA
VOCs	XYLMP	M.P.-XYLENE (SUM OF ISOMERS)	0	5	ND	ND	ND	NA

Notes:

1. Analytical results are presented in mg/L.
2. NA indicates not available.
3. ND indicates below detection limit; drawn from data sources where detection limits not available.
4. USEPA Region 5 Ecological Screening Levels (ECO SLs) for Surface Water - August, 2003..

Table 4. Summary Statistics for Sediment Sampling Results
Remedial Investigation/Feasibility Study
Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Analysis Method	CAS #	Parameter	# of Detections	# of Samples	Minimum Result (mg/kg)	Average Result (mg/kg)	Maximum Result (mg/kg)	Region 5 ECO SL (mg/kg)
Cyanide	57-12-5	CYANIDE	0	6	ND	ND	ND	0.0001
Metals	14808-79-8	SULFATE (AS SO4)	12	12	87.5	2530	25800	NA
Metals	18496-25-8	SULFIDE	2	12	ND	13.0	140	NA
Metals	3812-32-6	CARBONATE (AS CO3)	4	4	4.90	38.2	51.1	NA
Metals	57-12-5	CYANIDE	2	22	ND	0.0809	1.30	0.0001
Metals	71-52-3	BICARBONATE	4	4	289	501	638	NA
Metals	7429-90-5	ALUMINUM	25	33	ND	4470	20000	NA
Metals	7439-89-6	IRON	30	40	ND	33700	265000	NA
Metals	7439-92-1	LEAD	38	40	ND	186	1810	35.8
Metals	7439-95-4	MAGNESIUM	23	23	3900	16200	43300	NA
Metals	7439-96-5	MANGANESE	30	40	ND	11300	155000	NA
Metals	7439-97-6	MERCURY	32	40	ND	0.249	1.90	0.17
Metals	7440-02-0	NICKEL	38	40	ND	68.2	737	22.7
Metals	7440-09-7	POTASSIUM	29	33	ND	1230	6570	NA
Metals	7440-22-4	SILVER	14	33	ND	0.955	15.2	0.5
Metals	7440-23-5	SODIUM	23	33	ND	285	3960	NA
Metals	7440-28-0	THALLIUM	13	33	ND	0.0907	0.615	NA
Metals	7440-36-0	ANTIMONY	7	23	ND	8.29	58.4	NA
Metals	7440-38-2	ARSENIC	26	33	ND	8.63	42.8	9.8
Metals	7440-39-3	BARIUM	29	40	ND	584	7310	NA
Metals	7440-41-7	BERYLLIUM	29	33	ND	0.551	2.30	NA
Metals	7440-43-9	CADMIUM	38	40	ND	11.4	99.3	0.99
Metals	7440-47-3	CHROMIUM, TOTAL	36	40	ND	35.6	280	43.4
Metals	7440-48-4	COBALT	23	33	ND	6.65	29.5	50
Metals	7440-50-8	COPPER	29	33	ND	86.9	550	31.6
Metals	7440-62-2	VANADIUM	27	33	ND	20.6	68.8	NA
Metals	7440-66-6	ZINC	40	40	46.2	4320	87700	121
Metals	7440-70-2	CALCIUM	23	33	ND	48100	243000	NA
Metals	7782-49-2	SELENIUM	17	33	ND	0.475	5.40	NA
PCBs	11096-82-5	PCB-1260 (AROCHLOR 1260)	1	6	ND	0.32	1.9	NA
PCBs	11097-69-1	PCB-1254 (AROCHLOR 1254)	0	6	ND	ND	ND	NA
PCBs	11104-28-2	PCB-1221 (AROCHLOR 1221)	0	6	ND	ND	ND	NA
PCBs	11141-16-5	PCB-1232 (AROCHLOR 1232)	0	6	ND	ND	ND	NA
PCBs	12672-29-6	PCB-1248 (AROCHLOR 1248)	0	6	ND	ND	ND	NA
PCBs	12674-11-2	PCB-1016 (AROCHLOR 1016)	0	6	ND	ND	ND	NA
PCBs	53469-21-9	PCB-1242 (AROCHLOR 1242)	0	6	ND	ND	ND	NA
Pesticides	1024-57-3	HEPTACHLOR EPOXIDE	0	16	ND	ND	ND	0.0025
Pesticides	1031-07-8	ENDOSULFAN SULFATE	0	16	ND	ND	ND	0.035
Pesticides	11096-82-5	PCB-1260 (AROCHLOR 1260)	4	12	ND	0.022	0.19	NA
Pesticides	11097-69-1	PCB-1254 (AROCHLOR 1254)	7	12	ND	0.35	2.9	NA
Pesticides	11104-28-2	PCB-1221 (AROCHLOR 1221)	0	7	ND	ND	ND	NA
Pesticides	11141-16-5	PCB-1232 (AROCHLOR 1232)	0	7	ND	ND	ND	NA
Pesticides	12672-29-6	PCB-1248 (AROCHLOR 1248)	0	7	ND	ND	ND	NA
Pesticides	12674-11-2	PCB-1016 (AROCHLOR 1016)	0	7	ND	ND	ND	NA
Pesticides	12789-03-6	GAMMA-CHLORDANE	4	21	ND	0.00038	0.0051	NA
Pesticides	309-00-2	ALDRIN	0	21	ND	ND	ND	0.002
Pesticides	319-84-6	ALPHA BHC (ALPHA	0	21	ND	ND	ND	0.006
Pesticides	319-85-7	BETA BHC (BETA	0	21	ND	ND	ND	0.005
Pesticides	319-86-8	DELTA BHC (DELTA	4	21	ND	0.00030	0.0030	71.5
Pesticides	33213-65-9	BETA ENDOSULFAN	0	21	ND	ND	ND	0.0019
Pesticides	50-29-3	P,P'-DDT	4	21	ND	0.00066	0.0092	0.0042
Pesticides	5103-71-9	ALPHA-CHLORDANE	4	21	ND	0.0011	0.017	NA
Pesticides	53469-21-9	PCB-1242 (AROCHLOR 1242)	3	12	ND	0.077	0.81	NA
Pesticides	53494-70-5	ENDRIN KETONE	1	21	ND	0.000067	0.0014	NA
Pesticides	58-89-9	GAMMA BHC (LINDANE)	0	16	ND	ND	ND	0.0024
Pesticides	60-57-1	DIELDRIN	4	21	ND	0.0014	0.017	0.0019
Pesticides	72-20-8	ENDRIN	4	21	ND	0.0040	0.067	0.0022
Pesticides	72-43-5	METHOXYCHLOR	0	21	ND	ND	ND	0.014
Pesticides	72-54-8	P,P'-DDD	4	21	ND	0.00070	0.0097	0.0049
Pesticides	72-55-9	P,P'-DDE	1	21	ND	0.000067	0.0014	0.0032
Pesticides	7421-93-4	ENDRIN ALDEHYDE	1	21	ND	0.00047	0.0099	0.48
Pesticides	76-44-8	HEPTACHLOR	0	16	ND	ND	ND	0.0006
Pesticides	8001-35-2	TOXAPHENE	0	21	ND	ND	ND	0.000077
Pesticides	959-98-8	ALPHA ENDOSULFAN	0	21	ND	ND	ND	0.0033
SVOCs	100-01-6	4-NITROANILINE	0	14	ND	ND	ND	NA
SVOCs	100-02-7	4-NITROPHENOL	0	14	ND	ND	ND	0.013
SVOCs	100-52-7	BENZALDEHYDE	0	6	ND	ND	ND	NA
SVOCs	101-55-3	4-BROMOPHENYL PHENYL ETHER	0	14	ND	ND	ND	1.6
SVOCs	105-60-2	CAPROLACTAM	0	6	ND	ND	ND	NA
SVOCs	105-67-9	2,4-DIMETHYLPHENOL	0	14	ND	ND	ND	0.3
SVOCs	106-44-5	4-METHYLPHENOL (P-CRESOL)	0	14	ND	ND	ND	0.02
SVOCs	106-46-7	1,4-DICHLOROBENZENE	0	8	ND	ND	ND	0.32
SVOCs	106-47-8	4-CHLOROANILINE	0	14	ND	ND	ND	0.15
SVOCs	108-60-1	BIS(2-CHLOROISOPROPYL) ETHER	0	14	ND	ND	ND	NA
SVOCs	108-95-2	PHENOL	0	14	ND	ND	ND	0.049
SVOCs	111-44-4	BIS(2-CHLOROETHYL) ETHER (2-	0	14	ND	ND	ND	3.5
SVOCs	111-91-1	BIS(2-CHLOROETHOXY) METHANE	0	14	ND	ND	ND	NA
SVOCs	117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	8	14	ND	0.15	0.58	0.18
SVOCs	117-84-0	DI-N-OCTYLPHTHALATE	0	14	ND	ND	ND	40.6
SVOCs	118-74-1	HEXACHLOROBENZENE	0	19	ND	ND	ND	0.02
SVOCs	120-12-7	ANTHRACENE	3	18	ND	0.12	1.5	0.057
SVOCs	120-82-1	1,2,4-TRICHLOROBENZENE	0	8	ND	ND	ND	5.1
SVOCs	120-83-2	2,4-DICHLOROPHENOL	0	14	ND	ND	ND	0.082
SVOCs	121-14-2	2,4-DINITROTOLUENE	0	14	ND	ND	ND	0.014
SVOCs	129-00-0	PYRENE	5	23	ND	0.74	14	0.2
SVOCs	131-11-3	DIMETHYL PHTHALATE	0	14	ND	ND	ND	NA
SVOCs	132-64-9	DIBENZOFURAN	0	19	ND	ND	ND	0.45
SVOCs	1912-24-9	ATRAZINE	0	6	ND	ND	ND	NA
SVOCs	191-24-2	BENZO(G,H,I)PERYLENE	2	18	ND	0.25	4.4	0.17
SVOCs	193-39-5	INDENO(1,2,3-C,D)PYRENE	2	18	ND	0.21	3.7	0.2
SVOCs	205-99-2	BENZO(B)FLUORANTHENE	4	23	ND	0.32	5.3	10.4

Table 4. Summary Statistics for Sediment Sampling Results
Remedial Investigation/Feasibility Study
Mathiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Analysis Method	CAS #	Parameter	# of Detections	# of Samples	Minimum Result (mg/kg)	Average Result (mg/kg)	Maximum Result (mg/kg)	Region 5 ECO SL (mg/kg)
Cyanide	57-12-5	CYANIDE	0	6	ND	ND	ND	0.0001
Metals	14808-79-8	SULFATE (AS SO4)	12	12	87.5	2530	25800	NA
Metals	18496-25-8	SULFIDE	2	12	ND	13.0	140	NA
SVOCs	206-44-0	FLUORANTHENE	5	23	ND	0.76	14	0.42
SVOCs	207-08-9	BENZO(K)FLUORANTHENE	4	18	ND	0.34	5.3	0.24
SVOCs	208-96-8	ACENAPHTHYLENE	1	18	ND	0.078	1.4	0.0059
SVOCs	218-01-9	CHRYSENE	5	23	ND	0.38	7.0	0.17
SVOCs	50-32-8	BENZO(A)PYRENE	5	23	ND	0.35	6.7	0.15
SVOCs	51-28-5	2,4-DINITROPHENOL	0	14	ND	ND	ND	0.0062
SVOCs	534-52-1	4,6-DINITRO-2-METHYLPHENOL	0	14	ND	ND	ND	0.1
SVOCs	53-70-3	DIBENZO(A,H)ANTHRACENE	1	18	ND	0.061	1.1	0.033
SVOCs	541-73-1	1,3-DICHLOROBENZENE	0	8	ND	ND	ND	1.3
SVOCs	56-55-3	BENZO(A)ANTHRACENE	5	23	ND	0.36	6.7	0.11
SVOCs	59-50-7	4-CHLORO-3-METHYLPHENOL	0	14	ND	ND	ND	0.39
SVOCs	606-20-2	2,6-DINITROTOLUENE	0	14	ND	ND	ND	0.04
SVOCs	621-64-7	N-NITROSODI-N-PROPYLAMINE	0	14	ND	ND	ND	NA
SVOCs	67-72-1	HEXACHLOROETHANE	0	14	ND	ND	ND	0.58
SVOCs	7005-72-3	4-CHLOROPHENYL PHENYL ETHER	0	14	ND	ND	ND	NA
SVOCs	77-47-4	HEXACHLOROCYCLOPENTADIENE	0	14	ND	ND	ND	0.9
SVOCs	78-59-1	ISOPHORONE	0	14	ND	ND	ND	0.43
SVOCs	83-32-9	ACENAPHTHENE	1	18	ND	0.0089	0.16	0.0067
SVOCs	84-66-2	DIETHYL PHTHALATE	0	14	ND	ND	ND	0.3
SVOCs	84-74-2	DI-N-BUTYL PHTHALATE	0	14	ND	ND	ND	1.1
SVOCs	85-01-8	PHENANTHRENE	5	23	ND	0.35	6.0	0.2
SVOCs	85-68-7	BENZYL BUTYL PHTHALATE	0	14	ND	ND	ND	2
SVOCs	86-30-6	N-NITROSODIPHENYLAMINE	0	14	ND	ND	ND	NA
SVOCs	86-73-7	FLUORENE	0	18	ND	ND	ND	0.077
SVOCs	86-74-8	CARBAZOLE	1	14	ND	0.034	0.47	NA
SVOCs	87-68-3	HEXACHLOROBUTADIENE	0	14	ND	ND	ND	0.027
SVOCs	87-86-5	PENTACHLOROPHENOL	0	19	ND	ND	ND	23
SVOCs	88-06-2	2,4,6-TRICHLOROPHENOL	0	14	ND	ND	ND	0.21
SVOCs	88-74-4	2-NITROANILINE	0	14	ND	ND	ND	NA
SVOCs	88-75-5	2-NITROPHENOL	0	14	ND	ND	ND	NA
SVOCs	91-20-3	NAPHTHALENE	0	23	ND	ND	ND	0.18
SVOCs	91-57-6	2-METHYLNAPHTHALENE	0	19	ND	ND	ND	0.02
SVOCs	91-58-7	2-CHLORONAPHTHALENE	0	14	ND	ND	ND	0.42
SVOCs	91-94-1	3,3'-DICHLOROBENZIDINE	0	14	ND	ND	ND	0.13
SVOCs	92-52-4	BIPHENYL (DIPHENYL)	0	6	ND	ND	ND	NA
SVOCs	95-48-7	2-METHYLPHENOL (O-CRESOL)	0	14	ND	ND	ND	0.055
SVOCs	95-50-1	1,2-DICHLOROBENZENE	0	8	ND	ND	ND	0.29
SVOCs	95-57-8	2-CHLOROPHENOL	0	14	ND	ND	ND	0.032
SVOCs	95-95-4	2,4,5-TRICHLOROPHENOL	0	14	ND	ND	ND	NA
SVOCs	98-86-2	ACETOPHENONE	0	6	ND	ND	ND	NA
SVOCs	98-93-3	NITROBENZENE	0	14	ND	ND	ND	0.15
SVOCs	99-09-2	3-NITROANILINE	0	14	ND	ND	ND	NA
VOCs	100-41-4	ETHYLBENZENE	1	20	ND	0.000049	0.00097	0.18
VOCs	100-42-5	STYRENE	0	15	ND	ND	ND	0.25
VOCs	10061-01-5	CIS-1,3-DICHLOROPROPENE	0	15	ND	ND	ND	NA
VOCs	10061-02-6	TRANS-1,3-DICHLOROPROPENE	0	15	ND	ND	ND	NA
VOCs	106-46-7	1,4-DICHLOROBENZENE	0	7	ND	ND	ND	0.32
VOCs	106-93-4	1,2-DIBROMOETHANE (ETHYLENE)	0	7	ND	ND	ND	NA
VOCs	107-06-2	1,2-DICHLOROETHANE	0	15	ND	ND	ND	0.26
VOCs	108-10-1	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0	15	ND	ND	ND	0.025
VOCs	108-87-2	METHYLCYCLOHEXANE	5	7	ND	0.0017	0.0075	NA
VOCs	108-88-3	TOLUENE	8	20	ND	0.0015	0.011	1.2
VOCs	108-90-7	CHLOROBENZENE	0	15	ND	ND	ND	0.29
VOCs	110-82-7	CYCLOHEXANE	3	7	ND	0.0012	0.0061	NA
VOCs	120-82-1	1,2,4-TRICHLOROBENZENE	0	7	ND	ND	ND	5.1
VOCs	124-48-1	DIBROMOCHLOROMETHANE	0	15	ND	ND	ND	NA
VOCs	127-18-4	TETRACHLOROETHYLENE(PCE)	0	15	ND	ND	ND	0.99
VOCs	156-59-2	CIS-1,2-DICHLOROETHYLENE	0	7	ND	ND	ND	NA
VOCs	156-60-5	TRANS-1,2-DICHLOROETHYLENE	0	7	ND	ND	ND	0.65
VOCs	1634-04-4	TERT-BUTYL METHYL ETHER	0	7	ND	ND	ND	NA
VOCs	540-59-0	DICHLOROETHYLENES	1	8	ND	0.0010	0.0080	NA
VOCs	541-73-1	1,3-DICHLOROBENZENE	0	7	ND	ND	ND	1.3
VOCs	56-23-5	CARBON TETRACHLORIDE	0	15	ND	ND	ND	1.5
VOCs	591-78-6	2-HEXANONE	0	15	ND	ND	ND	0.058
VOCs	67-64-1	ACETONE	14	20	ND	0.069	0.41	0.0099
VOCs	67-66-3	CHLOROFORM	4	15	ND	0.00033	0.0020	0.12
VOCs	71-43-2	BENZENE	4	15	ND	0.00023	0.0011	0.14
VOCs	71-55-6	1,1,1-TRICHLOROETHANE	2	20	ND	0.00040	0.0060	0.21
VOCs	74-83-9	BROMOMETHANE	0	15	ND	ND	ND	0.0014
VOCs	74-87-3	CHLOROMETHANE	0	15	ND	ND	ND	NA
VOCs	75-00-3	CHLOROETHANE	0	15	ND	ND	ND	NA
VOCs	75-01-4	VINYL CHLORIDE	0	15	ND	ND	ND	0.2
VOCs	75-09-2	METHYLENE CHLORIDE	4	20	ND	0.00070	0.0070	0.16
VOCs	75-15-0	CARBON DISULFIDE	7	15	ND	0.0038	0.030	0.024
VOCs	75-25-2	BROMOFORM	0	15	ND	ND	ND	0.49
VOCs	75-27-4	BROMODICHLOROMETHANE	0	15	ND	ND	ND	NA
VOCs	75-34-3	1,1-DICHLOROETHANE	0	15	ND	ND	ND	0.00058
VOCs	75-35-4	1,1-DICHLOROETHYLENE	0	15	ND	ND	ND	0.019
VOCs	75-69-4	TRICHLOROFLUOROMETHANE	0	7	ND	ND	ND	NA
VOCs	75-71-8	DICHLORODIFLUOROMETHANE	0	7	ND	ND	ND	NA
VOCs	76-13-1	1,1,2-TRICHLORO-1,2,2-TRICHLOROETHANE	0	7	ND	ND	ND	NA
VOCs	78-87-5	1,2-DICHLOROPROPANE	0	15	ND	ND	ND	0.33
VOCs	78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	6	20	ND	0.012	0.14	0.042
VOCs	79-00-5	1,1,2-TRICHLOROETHANE	0	15	ND	ND	ND	0.52
VOCs	79-01-6	TRICHLOROETHYLENE (TCE)	1	15	ND	0.00051	0.0077	0.11
VOCs	79-20-9	METHYL ACETATE	3	7	ND	0.035	0.24	NA
VOCs	79-34-5	1,1,2,2-TETRACHLOROETHANE	0	15	ND	ND	ND	0.85
VOCs	95-47-6	O-XYLENE (1,2-DIMETHYLBENZENE)	0	7	ND	ND	ND	NA

Table 4. Summary Statistics for Sediment Sampling Results
Remedial Investigation/Feasibility Study
Mathiessen and Hegeler Zinc Company Site, OUI
LaSalle, Illinois

Analysis Method	CAS #	Parameter	# of Detections	# of Samples	Minimum Result (mg/kg)	Average Result (mg/kg)	Maximum Result (mg/kg)	Region 5 ECO SL (mg/kg)
Cyanide	57-12-5	CYANIDE	0	6	ND	ND	ND	0.0001
Metals	14808-79-8	SULFATE (AS SO ₄)	12	12	87.5	2530	25800	NA
Metals	18496-25-8	SULFIDE	2	12	ND	13.0	140	NA
VOCs	95-50-1	1,2-DICHLOROBENZENE	1	7	ND	0.0044	0.031	0.29
VOCs	96-12-8	1,2-DIBROMO-3-CHLOROPROPANE	0	7	ND	ND	ND	NA
VOCs	98-82-8	ISOPROPYLBENZENE (CUMENE)	0	7	ND	ND	ND	NA
VOCs	XYLENES	XYLENES, TOTAL	1	13	ND	0.00069	0.0090	0.43
VOCs	XYLMP	M,P-XYLENE (SUM OF ISOMERS)	1	7	ND	0.00013	0.00094	NA

Notes:

1. Analytical results are presented in mg/kg.
2. NA indicates not available.
3. ND indicates below detection limit; drawn from data sources where detection limits not available.
4. USEPA Region 5 Ecological Screening Levels (ECO SLs) for Sediment - August, 2003.

Table 5. Summary Statistics for Groundwater Sampling Results
Remedial Investigation/Feasibility Study
Matthiessen and Hegeler Zinc Company Site, OUI
LaSalle, Illinois

Analysis Method	CAS #	Parameter	# of Detections	# of Samples	Minimum Result (mg/L)	Average Result (mg/L)	Maximum Result (mg/L)	Region 9 Tapwater PRG	IEPA Class II TACO
Cyanide	57-12-5	CYANIDE	0	6	ND	ND	ND	0.73	0.6
Metals	14808-79-8	SULFATE (AS SO ₄)	25	25	114	1390	4440	NA	400
Metals	18496-25-8	SULFIDE	2	25	ND	0.928	20.9	NA	NA
Metals	3812-32-6	CARBONATE (AS CO ₃)	11	12	ND	0.242	0.526	NA	NA
Metals	57-12-5	CYANIDE	5	25	ND	0.0028	0.0434	0.73	0.6
Metals	71-52-3	BICARBONATE	12	12	4.96	292	466	NA	NA
Metals	7429-90-5	ALUMINUM	18	28	ND	9.64	123	36	NA
Metals	7439-89-6	IRON	37	40	ND	15.1	208	11	5
Metals	7439-92-1	LEAD	27	46	ND	0.0932	2.18	NA	0.1
Metals	7439-95-4	MAGNESIUM	28	28	30	106	195	NA	NA
Metals	7439-96-5	MANGANESE	40	40	0.0068	5.81	25.3	0.88	10
Metals	7439-97-6	MERCURY	6	46	ND	0.000382	0.0129	0.011	0.01
Metals	7440-02-0	NICKEL	35	40	ND	0.0923	1.09	0.73	2
Metals	2023695	POTASSIUM	28	28	2.42	53.5	178	NA	NA
Metals	7440-22-4	SILVER	9	33	ND	0.00556	0.055	0.18	NA
Metals	7440-23-5	SODIUM	28	28	12.9	262	2000	NA	NA
Metals	7440-28-0	THALLIUM	2	28	ND	0.0000625	0.0013	0.0024	0.02
Metals	7440-36-0	ANTIMONY	3	28	ND	0.00295	0.081	0.015	0.024
Metals	7440-38-2	ARSENIC	27	35	ND	0.0049	0.0221	0.000045	0.2
Metals	7440-39-3	BARIUM	45	46	ND	0.209	2.53	2.6	2
Metals	7440-41-7	BERYLLIUM	5	28	ND	0.000882	0.013	0.073	0.5
Metals	7440-43-9	CADMIUM	26	46	ND	0.0719	2.22	0.018	0.05
Metals	7440-47-3	CHROMIUM, TOTAL	19	46	ND	0.0284	0.417	55	1
Metals	7440-48-4	COBALT	22	28	ND	0.0215	0.101	0.73	1
Metals	7440-50-8	COPPER	22	28	ND	0.147	3.12	1.5	0.65
Metals	7440-62-2	VANADIUM	8	28	ND	0.0189	0.253	0.036	0.1
Metals	7440-66-6	ZINC	39	40	ND	35.1	831	11	10
Metals	7440-70-2	CALCIUM	27	28	ND	400	744	NA	NA
Metals	7782-49-2	SELENIUM	6	35	ND	0.000328	0.0027	0.18	0.05
Metals	TSS	Total Suspended Solids	7	8	ND	46.3	252	NA	NA
Pesticides	1024-57-3	HEPTACHLOR EPOXIDE	0	8	ND	ND	ND	0.0000074	0.001
Pesticides	1031-07-8	ENDOSULFAN SULFATE	0	8	ND	ND	ND	NA	NA
Pesticides	11096-82-5	PCB-1260 (AROCHLOR 1260)	0	8	ND	ND	ND	0.000034	NA
Pesticides	11097-69-1	PCB-1254 (AROCHLOR 1254)	0	8	ND	ND	ND	0.000034	NA
Pesticides	11104-28-2	PCB-1221 (AROCHLOR 1221)	0	8	ND	ND	ND	0.000034	NA
Pesticides	11141-16-5	PCB-1232 (AROCHLOR 1232)	0	8	ND	ND	ND	0.000034	NA
Pesticides	12672-29-6	PCB-1248 (AROCHLOR 1248)	0	8	ND	ND	ND	0.000034	NA
Pesticides	12674-11-2	PCB-1016 (AROCHLOR 1016)	0	8	ND	ND	ND	0.000096	NA
Pesticides	12789-03-6	GAMMA-CHLORDANE	1	8	ND	0.0000074	0.000059	NA	NA
Pesticides	309-00-2	ALDRIN	0	8	ND	ND	ND	0.000004	0.07
Pesticides	319-84-6	ALPHA BHC	0	8	ND	ND	ND	0.000011	0.00055
Pesticides	319-85-7	BETA BHC	0	8	ND	ND	ND	0.000037	NA
Pesticides	319-86-8	DELTA BHC	0	8	ND	ND	ND	NA	NA
Pesticides	33213-65-9	BETA ENDOSULFAN	0	8	ND	ND	ND	NA	NA
Pesticides	50-29-3	P,P'-DDT	0	8	ND	ND	ND	0.0002	0.03
Pesticides	5103-71-9	ALPHA-CHLORDANE	0	8	ND	ND	ND	NA	NA
Pesticides	53469-21-9	PCB-1242 (AROCHLOR 1242)	0	8	ND	ND	ND	0.000034	NA
Pesticides	53494-70-5	ENDRIN KETONE	0	8	ND	ND	ND	NA	NA
Pesticides	58-89-9	GAMMA BHC (LINDANE)	0	8	ND	ND	ND	0.000052	NA
Pesticides	60-57-1	DIELDRIN	0	8	ND	ND	ND	0.0000042	0.045
Pesticides	72-20-8	ENDRIN	0	8	ND	ND	ND	0.011	0.01
Pesticides	72-43-5	METHOXYCHLOR	0	8	ND	ND	ND	0.18	0.2
Pesticides	72-54-8	P,P'-DDD	0	8	ND	ND	ND	0.00028	0.07
Pesticides	72-55-9	P,P'-DDE	0	8	ND	ND	ND	0.0002	0.05
Pesticides	7421-93-4	ENDRIN ALDEHYDE	0	8	ND	ND	ND	NA	NA
Pesticides	76-44-8	HEPTACHLOR	0	8	ND	ND	ND	0.000015	0.002
Pesticides	8001-35-2	TOXAPHENE	0	8	ND	ND	ND	0.000061	0.015
Pesticides	959-98-8	ALPHA ENDOSULFAN	0	8	ND	ND	ND	NA	NA
Phosphorus	PO ₄	PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	4	7	ND	0.00881	0.0223	NA	NA
Sulfate	14808-79-8	SULFATE (AS SO ₄)	7	7	521	1140	2380	NA	400
SVOCs	100-01-6	4-NITROANILINE	0	14	ND	ND	ND	0.0032	NA
SVOCs	100-02-7	4-NITROPHENOL	0	14	ND	ND	ND	NA	NA
SVOCs	100-52-7	BENZALDEHYDE	0	6	ND	ND	ND	3.6	NA
SVOCs	101-55-3	4-BROMOPHENYL PHENYL ETHER	0	14	ND	ND	ND	NA	NA
SVOCs	105-60-2	CAPROLACTAM	0	6	ND	ND	ND	18	NA
SVOCs	105-67-9	2,4-DIMETHYLPHENOL	0	14	ND	ND	ND	0.73	0.14
SVOCs	106-44-5	4-METHYLPHENOL (P-CRESOL)	0	14	ND	ND	ND	0.18	NA
SVOCs	106-46-7	1,4-DICHLOROBENZENE	0	8	ND	ND	ND	0.0005	0.375
SVOCs	106-47-8	4-CHLOROANILINE	0	14	ND	ND	ND	0.15	NA
SVOCs	108-60-1	BIS(2-CHLOROISOPROPYL) ETHER	0	14	ND	ND	ND	0.00027	NA
SVOCs	108-95-2	PHENOL	0	14	ND	ND	ND	11	0.1
SVOCs	111-44-4	BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	0	14	ND	ND	ND	0.00001	0.01
SVOCs	111-91-1	BIS(2-CHLOROETHOXY) METHANE	0	14	ND	ND	ND	NA	NA
SVOCs	117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	1	14	ND	0.0005	0.007	0.0048	NA
SVOCs	117-84-0	DI-N-OCTYLPHTHALATE	0	14	ND	ND	ND	1.5	0.7
SVOCs	118-74-1	HEXACHLOROBENZENE	0	14	ND	ND	ND	0.000042	0.0003
SVOCs	120-12-7	ANTHRACENE	0	18	ND	ND	ND	1.8	10.5
SVOCs	120-82-1	1,2,4-TRICHLOROBENZENE	0	8	ND	ND	ND	0.0072	0.7
SVOCs	120-83-2	2,4-DICHLOROPHENOL	0	14	ND	ND	ND	0.11	0.021

Table 5. Summary Statistics for Groundwater Sampling Results
Remedial Investigation/Feasibility Study
Mathiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Analysis Method	CAS #	Parameter	# of Detections	# of Samples	Minimum Result (mg/L)	Average Result (mg/L)	Maximum Result (mg/L)	Region 9 Tapwater PRG	IEPA Class II TACO
SVOCs	121-14-2	2,4-DINITROTOLUENE	0	14	ND	ND	ND	0.073	0.00002
SVOCs	129-00-0	PYRENE	0	18	ND	ND	ND	0.18	1.05
SVOCs	131-11-3	DIMETHYL PHTHALATE	0	14	ND	ND	ND	360	NA
SVOCs	132-64-9	DIBENZOFURAN	0	14	ND	ND	ND	0.012	NA
SVOCs	1912-24-9	ATRAZINE	0	6	ND	ND	ND	0.0003	0.015
SVOCs	191-24-2	BENZO(G,H,I)PERYLENE	0	18	ND	ND	ND	NA	NA
SVOCs	193-39-5	INDENO(1,2,3-C,D)PYRENE	0	18	ND	ND	ND	0.000092	0.00215
SVOCs	205-99-2	BENZO(B)FLUORANTHENE	0	17	ND	ND	ND	0.000092	0.0009
SVOCs	206-44-0	FLUORANTHENE	1	18	ND	0.000056	0.001	1.5	1.4
SVOCs	207-08-9	BENZO(K)FLUORANTHENE	0	18	ND	ND	ND	0.00092	0.00085
SVOCs	208-96-8	ACENAPHTHYLENE	0	18	ND	ND	ND	NA	NA
SVOCs	218-01-9	CHRYSENE	1	18	ND	0.00013	0.0024	0.0092	0.0075
SVOCs	50-32-8	BENZO(A)PYRENE	0	18	ND	ND	ND	0.000092	0.002
SVOCs	51-28-5	2,4-DINITROPHENOL	0	14	ND	ND	ND	0.073	0.014
SVOCs	534-52-1	4,6-DINITRO-2-METHYLPHENOL	0	14	ND	ND	ND	0.0036	NA
SVOCs	53-70-3	DIBENZ(A,H)ANTHRACENE	0	18	ND	ND	ND	0.000092	0.0013
SVOCs	541-73-1	1,3-DICHLOROBENZENE	0	8	ND	ND	ND	0.18	NA
SVOCs	56-55-3	BENZO(A)ANTHRACENE	0	18	ND	ND	ND	0.000092	0.00065
SVOCs	59-50-7	4-CHLORO-3-METHYLPHENOL	0	14	ND	ND	ND	NA	NA
SVOCs	606-20-2	2,6-DINITROTOLUENE	0	14	ND	ND	ND	0.036	0.00031
SVOCs	621-64-7	N-NITROSODI-N-PROPYLAMINE	0	14	ND	ND	ND	0.000096	0.0018
SVOCs	67-72-1	HEXACHLOROETHANE	0	14	ND	ND	ND	0.0048	0.035
SVOCs	7005-72-3	4-CHLOROPHENYL PHENYL ETHER	0	14	ND	ND	ND	NA	NA
SVOCs	77-47-4	HEXACHLOROCYCLOPENTADIENE	0	14	ND	ND	ND	0.22	0.5
SVOCs	78-59-1	ISOPHORONE	0	14	ND	ND	ND	0.071	1.4
SVOCs	83-32-9	ACENAPHTHENE	0	18	ND	ND	ND	0.37	2.1
SVOCs	84-66-2	DIETHYL PHTHALATE	0	14	ND	ND	ND	29	5.6
SVOCs	84-74-2	DI-N-BUTYL PHTHALATE	3	14	ND	0.0005	0.003	3.6	3.5
SVOCs	85-01-8	PHENANTHRENE	0	18	ND	ND	ND	NA	NA
SVOCs	85-68-7	BENZYL BUTYL PHTHALATE	0	14	ND	ND	ND	7.3	7
SVOCs	86-30-6	N-NITROSODIPHENYLAMINE	0	14	ND	ND	ND	0.014	0.016
SVOCs	86-73-7	FLUORENE	0	18	ND	ND	ND	0.24	1.4
SVOCs	86-74-8	CARBAZOLE	0	14	ND	ND	ND	0.0034	NA
SVOCs	87-68-3	HEXACHLOROBUTADIENE	0	14	ND	ND	ND	0.00086	NA
SVOCs	87-86-5	PENTACHLOROPHENOL	0	14	ND	ND	ND	0.00056	0.005
SVOCs	88-06-2	2,4,6-TRICHLOROPHENOL	0	14	ND	ND	ND	0.0036	NA
SVOCs	88-74-4	2-NITROANILINE	0	14	ND	ND	ND	0.11	NA
SVOCs	88-75-5	2-NITROPHENOL	0	14	ND	ND	ND	NA	NA
SVOCs	91-20-3	NAPHTHALENE	3	18	ND	0.0051	0.045	0.0062	0.22
SVOCs	91-57-6	2-METHYLNAPHTHALENE	0	14	ND	ND	ND	NA	NA
SVOCs	91-58-7	2-CHLORONAPHTHALENE	0	14	ND	ND	ND	0.49	NA
SVOCs	91-94-1	3,3'-DICHLOROBENZIDINE	0	14	ND	ND	ND	0.00015	NA
SVOCs	92-52-4	BIPHENYL (DIPHENYL)	0	6	ND	ND	ND	0.3	NA
SVOCs	95-48-7	2-METHYLPHENOL (O-CRESOL)	0	14	ND	ND	ND	1.8	0.35
SVOCs	95-50-1	1,2-DICHLOROBENZENE	0	8	ND	ND	ND	0.37	1.5
SVOCs	95-57-8	2-CHLOROPHENOL	0	14	ND	ND	ND	0.03	NA
SVOCs	95-95-4	2,4,5-TRICHLOROPHENOL	0	14	ND	ND	ND	3.6	NA
SVOCs	98-86-2	ACETOPHENONE	0	6	ND	ND	ND	NA	NA
SVOCs	98-95-3	NITROBENZENE	0	14	ND	ND	ND	0.0034	0.0035
SVOCs	99-09-2	3-NITROANILINE	0	14	ND	ND	ND	0.0032	NA
Total Carbon	7440-44-0	TOTAL CARBON	8	8	1.39	2.32	3.07	NA	NA
VOCs	100-41-4	ETHYLBENZENE	2	16	ND	0.084	0.95	1.3	1
VOCs	100-42-5	STYRENE	0	13	ND	ND	ND	1.6	0.5
VOCs	10061-01-5	CIS-1,3-DICHLOROPROPENE	0	13	ND	ND	ND	NA	NA
VOCs	10061-02-6	TRANS-1,3-DICHLOROPROPENE	0	13	ND	ND	ND	NA	NA
VOCs	106-46-7	1,4-DICHLOROBENZENE	0	5	ND	ND	ND	0.0005	0.375
VOCs	106-93-4	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0	5	ND	ND	ND	0.000056	0.0005
VOCs	107-06-2	1,2-DICHLOROETHANE	1	13	ND	0.00012	0.0016	0.00012	0.025
VOCs	108-10-1	METHYL ISOBUTYL KETONE (4-METHYL-2 PENTANONE)	0	13	ND	ND	ND	2	NA
VOCs	108-87-2	METHYLCYCLOHEXANE	0	5	ND	ND	ND	5.2	NA
VOCs	108-88-3	TOLUENE	2	16	ND	0.038	0.36	0.72	2.5
VOCs	108-90-7	CHLOROBENZENE	0	13	ND	ND	ND	0.11	0.5
VOCs	110-82-7	CYCLOHEXANE	0	5	ND	ND	ND	10	NA
VOCs	120-82-1	1,2,4-TRICHLOROBENZENE	0	5	ND	ND	ND	0.0072	0.7
VOCs	124-48-1	DIBROMOCHLOROMETHANE	0	13	ND	ND	ND	0.00013	0.14
VOCs	127-18-4	TETRACHLOROETHYLENE(PCE)	0	13	ND	ND	ND	0.0001	0.025
VOCs	156-59-2	CIS-1,2-DICHLOROETHYLENE	0	5	ND	ND	ND	0.061	0.2
VOCs	156-60-5	TRANS-1,2-DICHLOROETHYLENE	0	5	ND	ND	ND	0.12	0.5
VOCs	1634-04-4	TERT-BUTYL METHYL ETHER	0	5	ND	ND	ND	0.011	0.07
VOCs	205-99-2	BENZO(B)FLUORANTHENE	0	1	ND	ND	ND	0.000092	0.0009
VOCs	540-59-0	DICHLOROETHYLENES	1	8	ND	0.0024	0.019	NA	NA
VOCs	541-73-1	1,3-DICHLOROBENZENE	0	5	ND	ND	ND	0.18	NA
VOCs	56-23-5	CARBON TETRACHLORIDE	0	13	ND	ND	ND	0.00017	0.025
VOCs	591-78-6	2-HEXANONE	0	13	ND	ND	ND	NA	NA
VOCs	67-64-1	ACETONE	1	13	ND	0.00038	0.005	5.5	6.3
VOCs	67-66-3	CHLOROFORM	0	13	ND	ND	ND	0.00017	0.001
VOCs	71-43-2	BENZENE	2	16	ND	0.089	0.87	0.00035	0.025
VOCs	71-55-6	1,1,1-TRICHLOROETHANE	1	13	ND	0.0015	0.019	3.2	1
VOCs	74-83-9	BROMOMETHANE	0	13	ND	ND	ND	0.0087	0.049

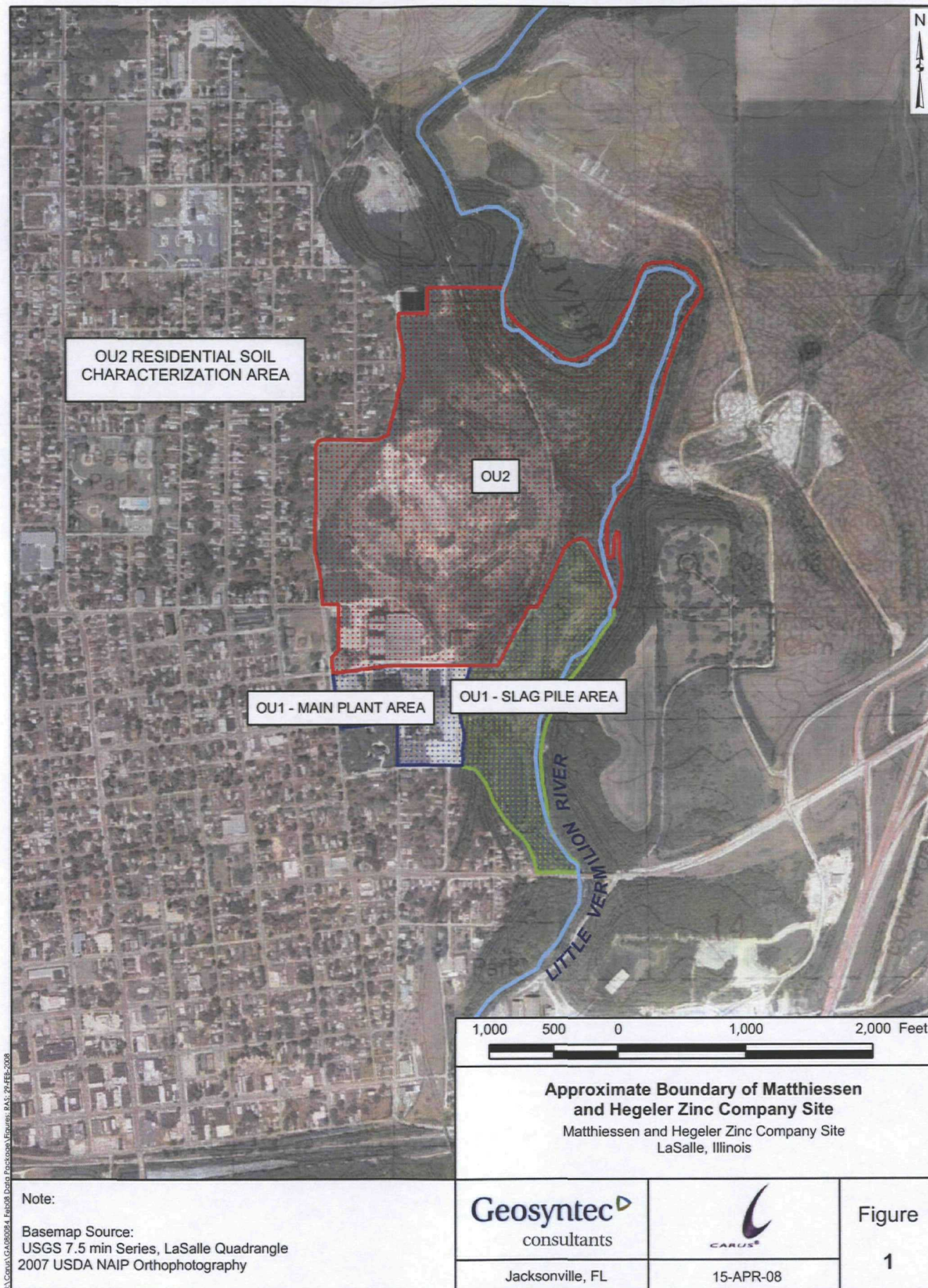
Table 5. Summary Statistics for Groundwater Sampling Results
Remedial Investigation/Feasibility Study
Matthiessen and Hegeler Zinc Company Site, OUI
LaSalle, Illinois

Analysis Method	CAS #	Parameter	# of Detections	# of Samples	Minimum Result (mg/L)	Average Result (mg/L)	Maximum Result (mg/L)	Region 9 Tapwater PRG	IEPA Class II TACO
VOCs	74-87-3	CHLOROMETHANE	0	13	ND	ND	ND	0.16	NA
VOCs	75-00-3	CHLOROETHANE	0	13	ND	ND	ND	0.0046	NA
VOCs	75-01-4	VINYL CHLORIDE	1	13	ND	0.000042	0.00055	0.00002	0.01
VOCs	75-09-2	METHYLENE CHLORIDE	2	13	ND	0.00025	0.003	0.0043	0.05
VOCs	75-15-0	CARBON DISULFIDE	0	13	ND	ND	ND	1	3.5
VOCs	75-25-2	BROMOFORM	0	13	ND	ND	ND	0.0085	0.001
VOCs	75-27-4	BROMODICHLOROMETHANE	0	13	ND	ND	ND	0.00018	0.0002
VOCs	75-34-3	1,1-DICHLOROETHANE	0	13	ND	ND	ND	0.81	3.5
VOCs	75-35-4	1,1-DICHLOROETHENE	0	13	ND	ND	ND	0.34	0.035
VOCs	75-69-4	TRICHLOROFLUOROMETHANE	0	5	ND	ND	ND	1.3	NA
VOCs	75-71-8	DICHLORODIFLUOROMETHANE	0	5	ND	ND	ND	0.39	NA
VOCs	76-13-1	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0	5	ND	ND	ND	59	NA
VOCs	78-87-5	1,2-DICHLOROPROPANE	0	13	ND	ND	ND	0.00016	0.025
VOCs	78-93-3	METHYL ETHYL KETONE	0	13	ND	ND	ND	7	NA
VOCs	79-00-5	1,1,2-TRICHLOROETHANE	0	13	ND	ND	ND	0.0002	0.05
VOCs	79-01-6	TRICHLOROETHYLENE (TCE)	2	13	ND	0.0024	0.031	0.000028	0.025
VOCs	79-20-9	METHYL ACETATE	0	5	ND	ND	ND	6.1	NA
VOCs	79-34-5	1,1,2,2-TETRACHLOROETHANE	0	13	ND	ND	ND	0.000055	NA
VOCs	95-47-6	O-XYLENE (1,2-DIMETHYLBENZENE)	0	5	ND	ND	ND	NA	NA
VOCs	95-50-1	1,2-DICHLOROBENZENE	0	5	ND	ND	ND	0.37	1.5
VOCs	96-12-8	1,2-DIBROMO-3-CHLOROPROPANE	0	5	ND	ND	ND	0.000048	0.002
VOCs	98-82-8	ISOPROPYLBENZENE (CUMENE)	0	5	ND	ND	ND	0.66	NA
VOCs	XYLENES	XYLENES, TOTAL	2	11	ND	0.24	1.4	0.21	10
VOCs	XYLMP	M,P-XYLENE (SUM OF ISOMERS)	0	5	ND	ND	ND	NA	NA

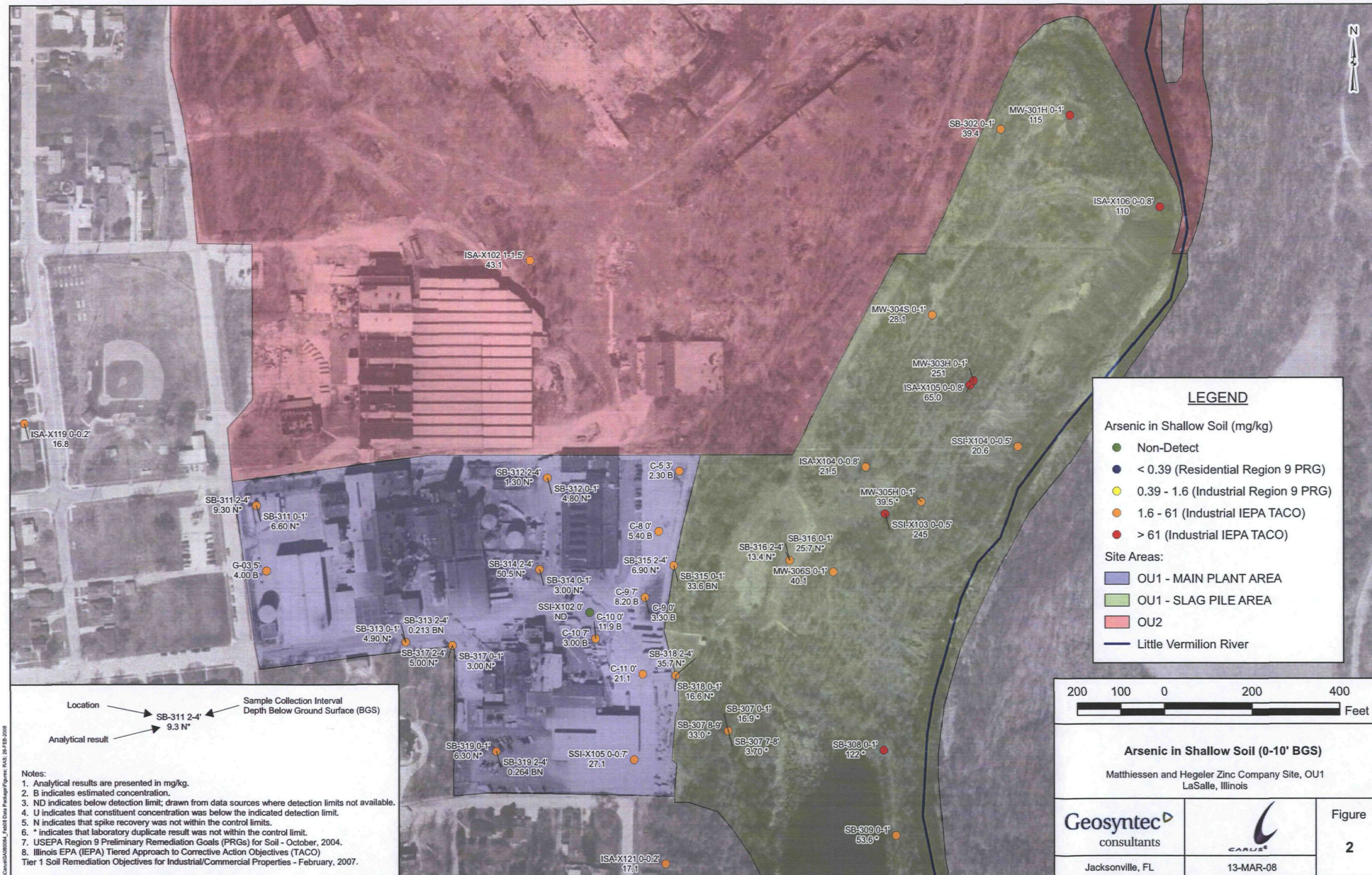
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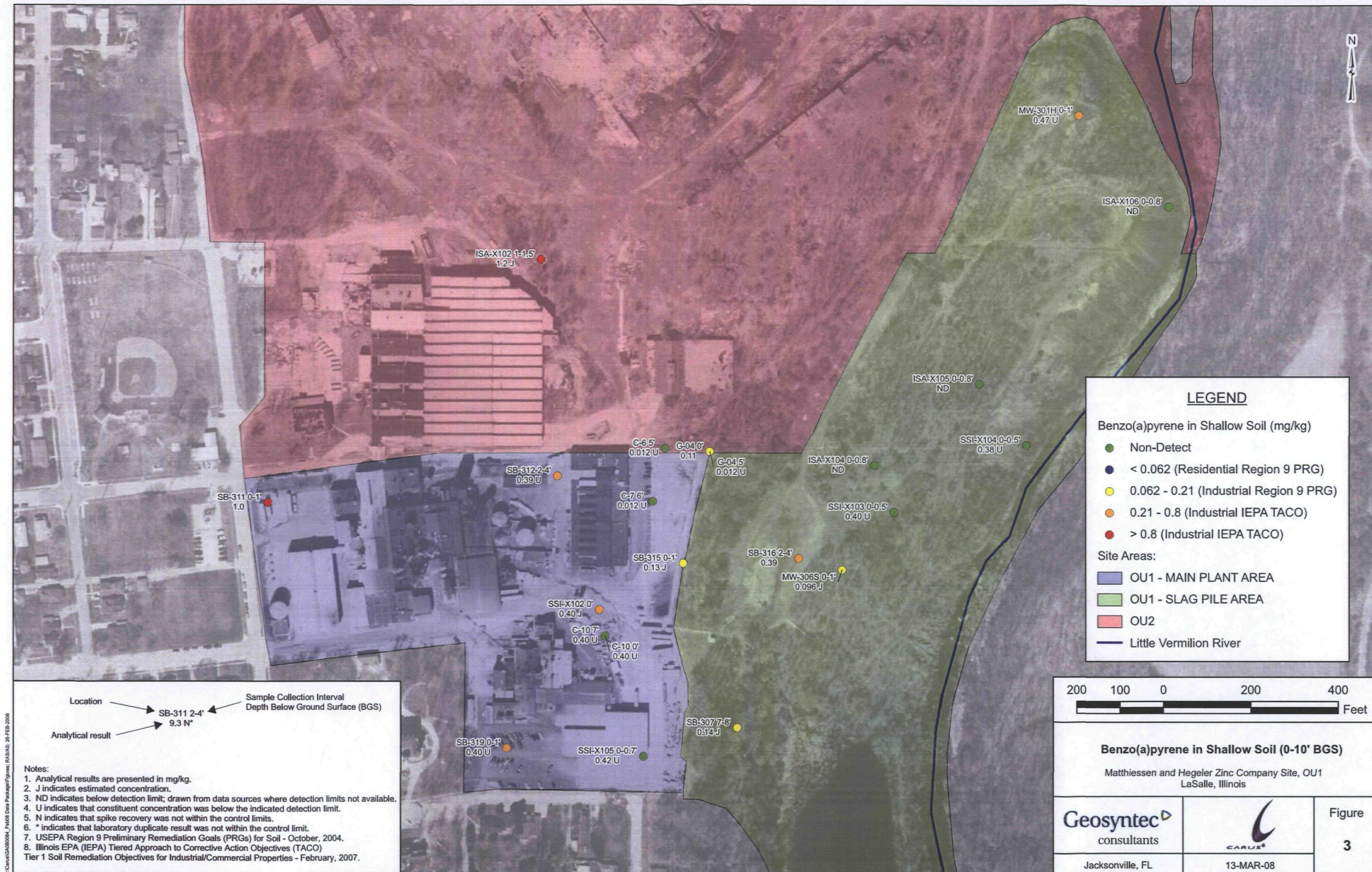
1. Analytical results are presented in mg/L.
2. NA indicates not available.
3. ND indicates below detection limit.
4. USEPA Region 9 Preliminary Remediation Goals (PRGs) for Tapwater - October, 2004.
5. Illinois EPA (IEPA) Tiered Approach to Corrective Action Objectives (TACO)
Tier I Soil Remediation Objectives for the Soil Component of the Groundwater Ingestion Route for a Class II Aquifer - February, 2007.
6. The average result was computed using detected concentrations and half detection limits for non-detect results.

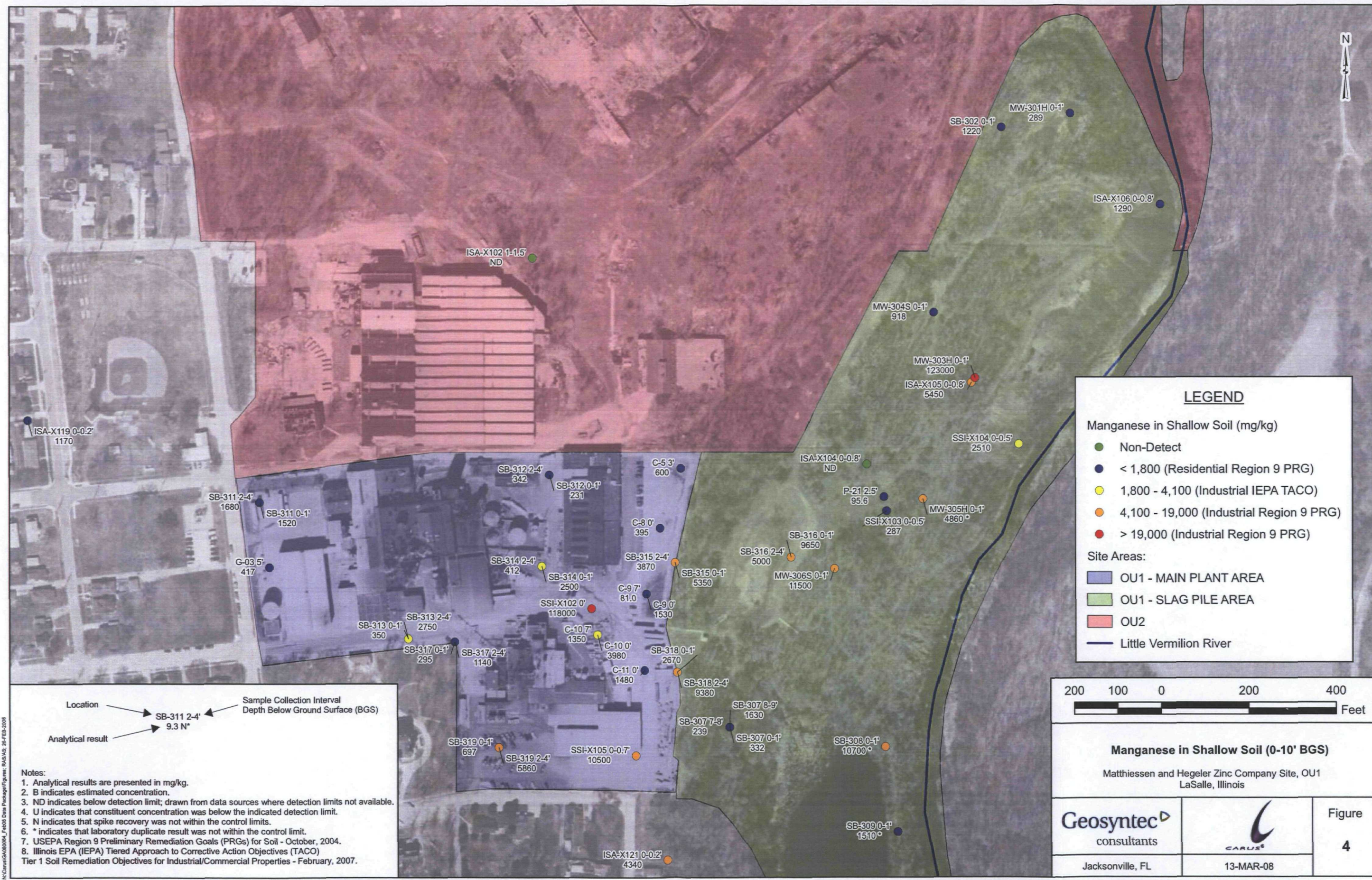
FIGURES



NAIP0808040804_Esp08 Data Product: Figure: RAS: 29-FEB-2008







Location → SB-311 2-4' ← Sample Collection Interval
Analytical result → 9.3 N* ← Depth Below Ground Surface (BGS)

Notes:
1. Analytical results are presented in mg/kg.
2. B indicates estimated concentration.
3. ND indicates below detection limit; drawn from data sources where detection limits not available.
4. U indicates that constituent concentration was below the indicated detection limit.
5. N indicates that spike recovery was not within the control limits.
6. * indicates that laboratory duplicate result was not within the control limit.
7. USEPA Region 9 Preliminary Remediation Goals (PRGs) for Soil - October, 2004.
8. Illinois EPA (IEPA) Tiered Approach to Corrective Action Objectives (TACO)
Tier 1 Soil Remediation Objectives for Industrial/Commercial Properties - February, 2007.

LEGEND

Manganese in Shallow Soil (mg/kg)

- Non-Detect
- < 1,800 (Residential Region 9 PRG)
- 1,800 - 4,100 (Industrial IEPA TACO)
- 4,100 - 19,000 (Industrial Region 9 PRG)
- > 19,000 (Industrial Region 9 PRG)

Site Areas:

- OU1 - MAIN PLANT AREA
- OU1 - SLAG PILE AREA
- OU2
- Little Vermilion River

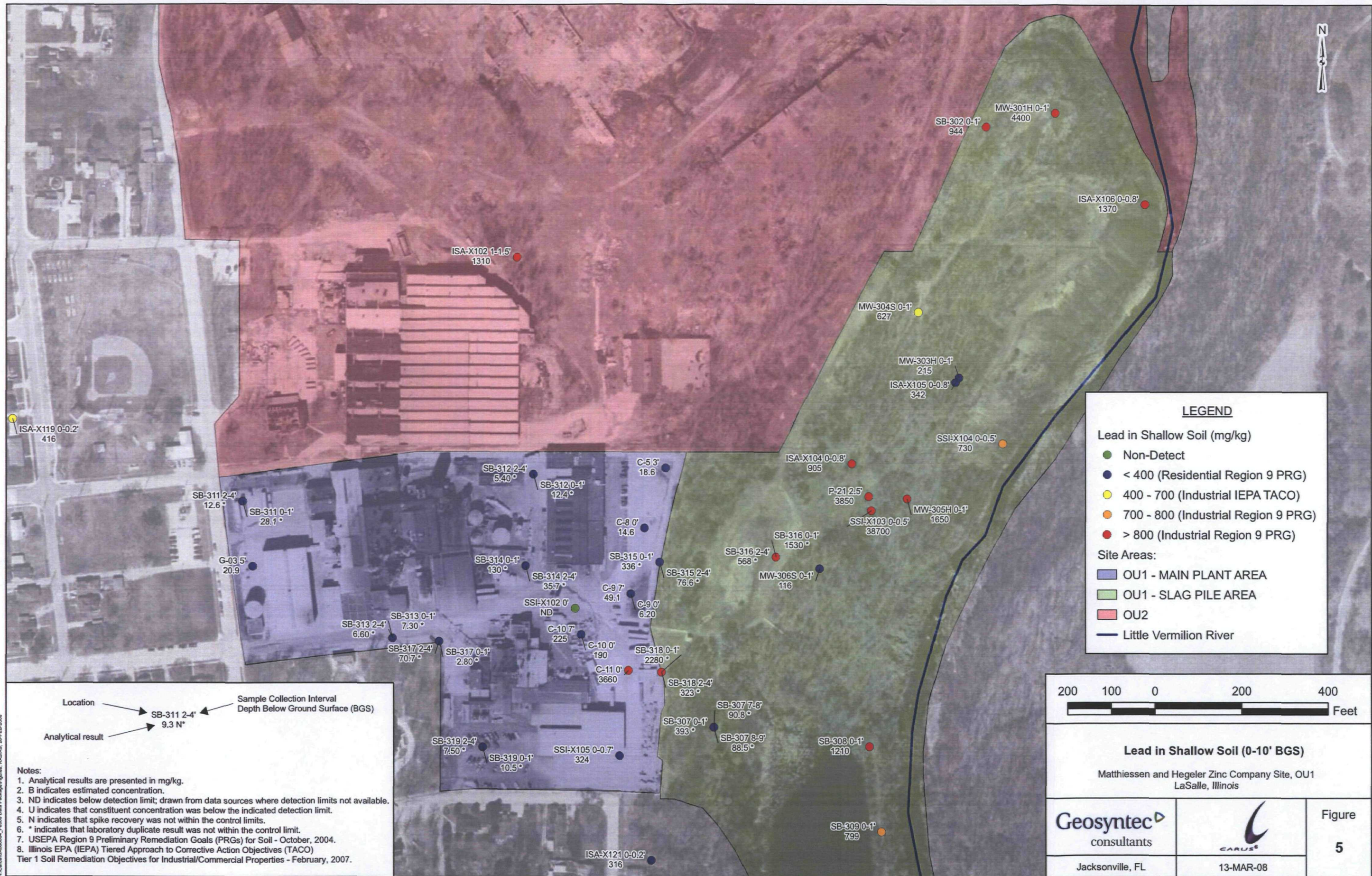
200 100 0 200 400
Feet

Manganese in Shallow Soil (0-10' BGS)
Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

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CARUS
13-MAR-08

Figure
4



Location
Analytical result
Sample Collection Interval
Depth Below Ground Surface (BGS)

SB-311 2-4'
9.3 N°

Notes:
1. Analytical results are presented in mg/kg.
2. B indicates estimated concentration.
3. ND indicates below detection limit; drawn from data sources where detection limits not available.
4. U indicates that constituent concentration was below the indicated detection limit.
5. N indicates that spike recovery was not within the control limits.
6. * indicates that laboratory duplicate result was not within the control limit.
7. USEPA Region 9 Preliminary Remediation Goals (PRGs) for Soil - October, 2004.
8. Illinois EPA (IEPA) Tiered Approach to Corrective Action Objectives (TACO)
Tier 1 Soil Remediation Objectives for Industrial/Commercial Properties - February, 2007.

LEGEND

Lead in Shallow Soil (mg/kg)

- Non-Detect
- < 400 (Residential Region 9 PRG)
- 400 - 700 (Industrial IEPA TACO)
- 700 - 800 (Industrial Region 9 PRG)
- > 800 (Industrial Region 9 PRG)

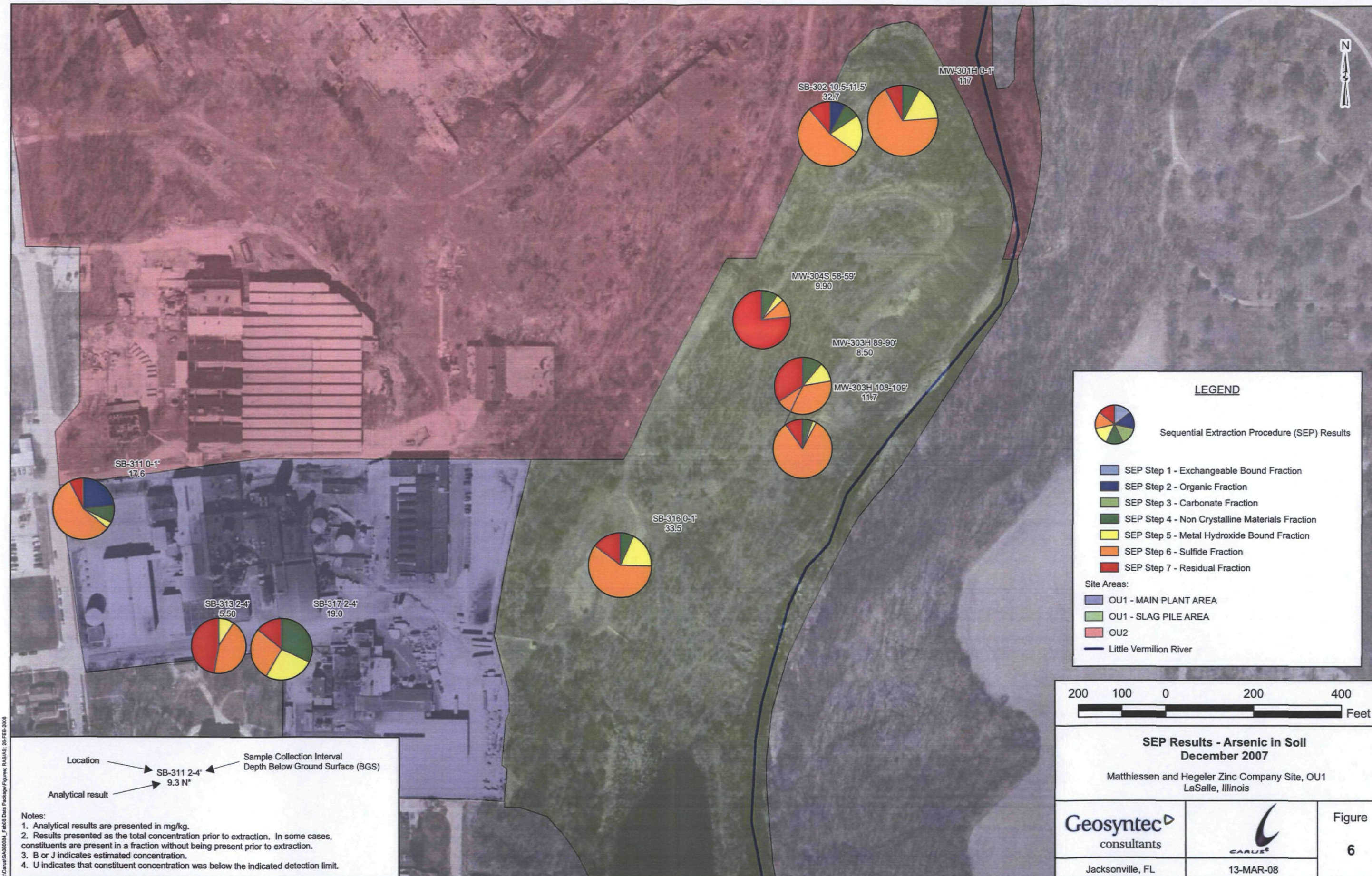
Site Areas:

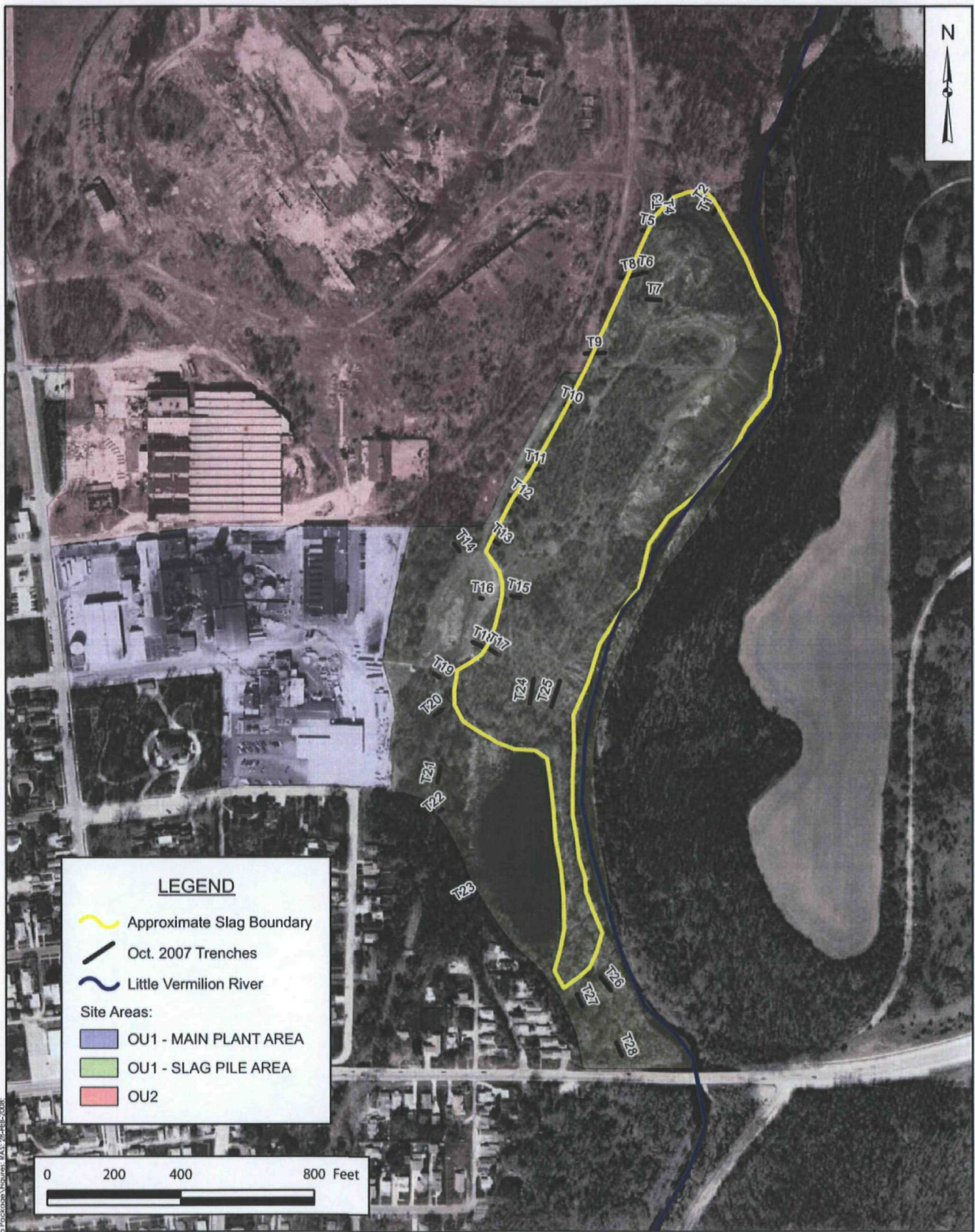
- OU1 - MAIN PLANT AREA
- OU1 - SLAG PILE AREA
- OU2
- Little Vermilion River

200 100 0 200 400
Feet

Lead in Shallow Soil (0-10' BGS)
Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Geosyntec consultants		Figure 5
Jacksonville, FL	13-MAR-08	





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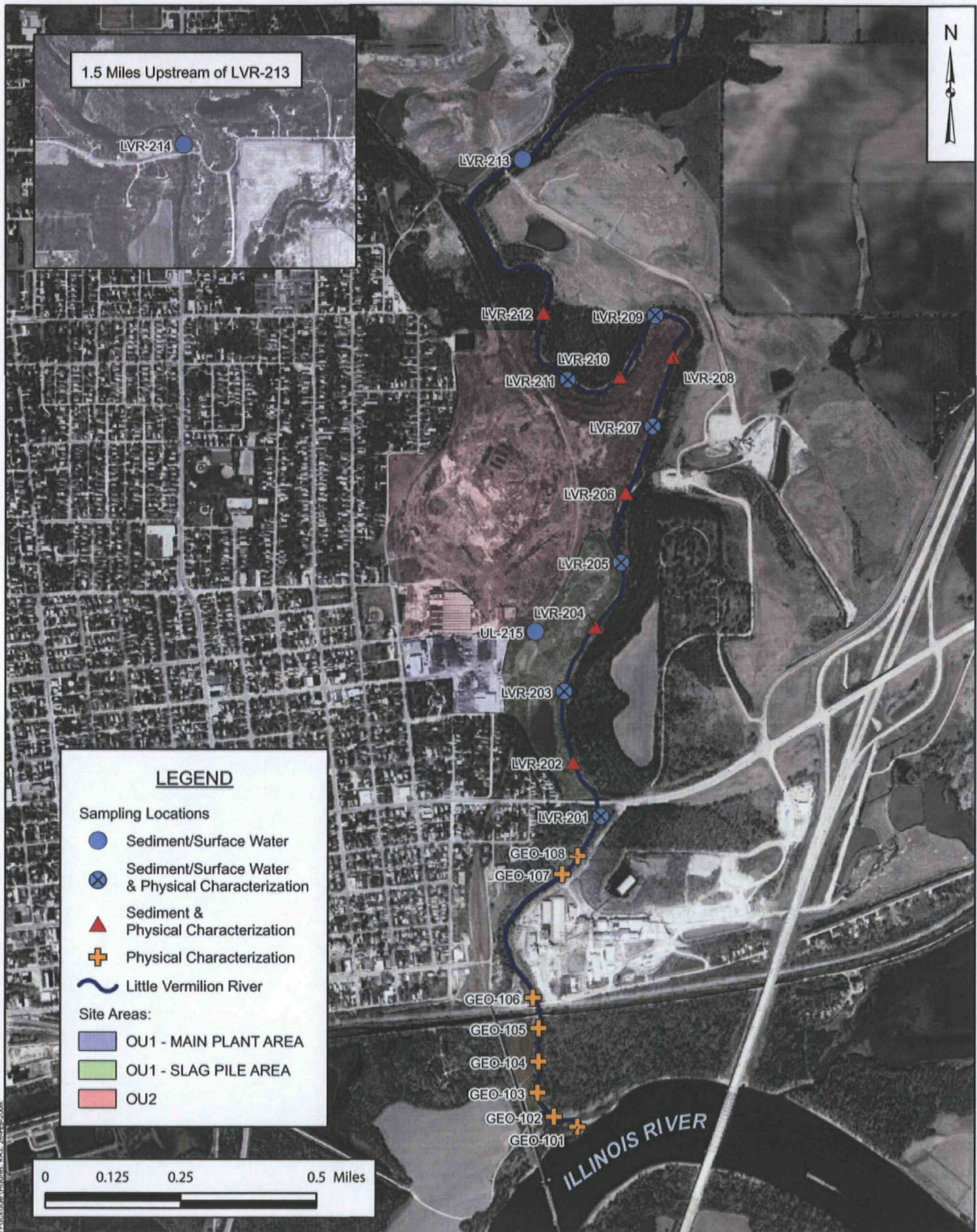
13-MAR-08

Slag Boundary Delineation

Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Figure

7



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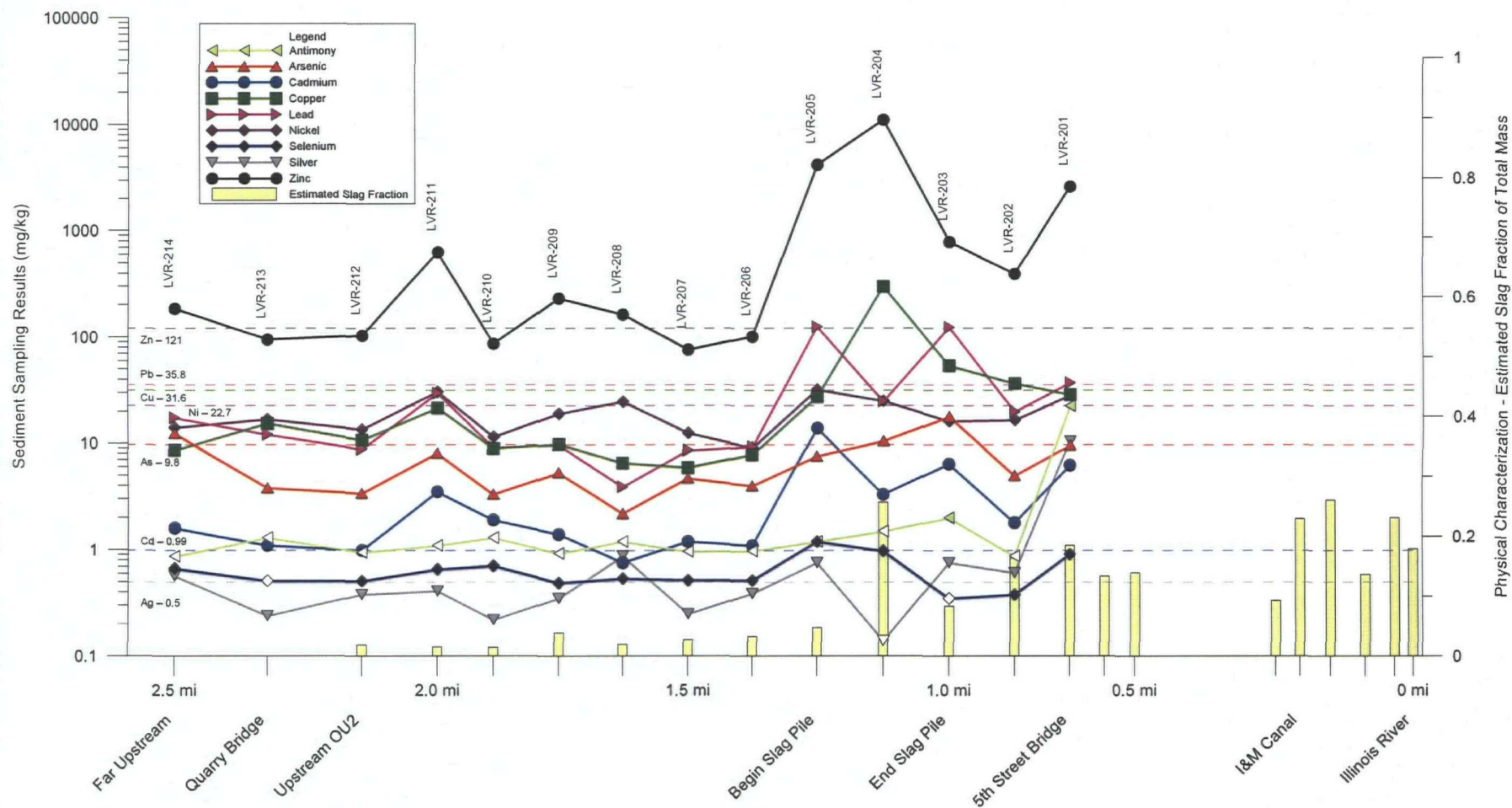
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Sediment and Surface Water Characterization

Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Figure

8



Little Vermilion River Sediment Sampling and Physical Characterization Results

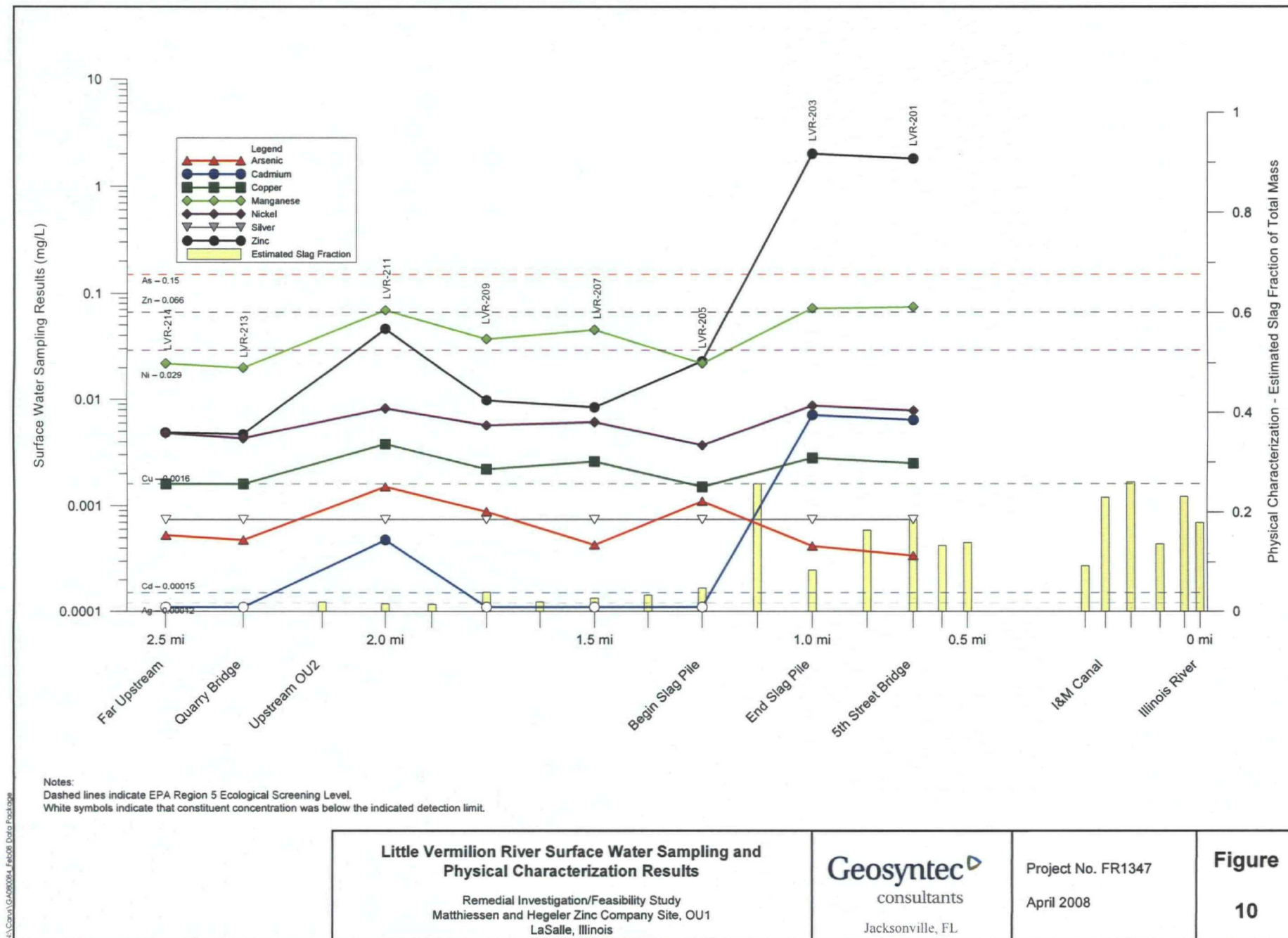
Remedial Investigation/Feasibility Study
 Matthiessen and Hegeler Zinc Company Site, OU1
 LaSalle, Illinois

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 consultants
 Jacksonville, FL

Project No. FR1347
 April 2008

Figure

9



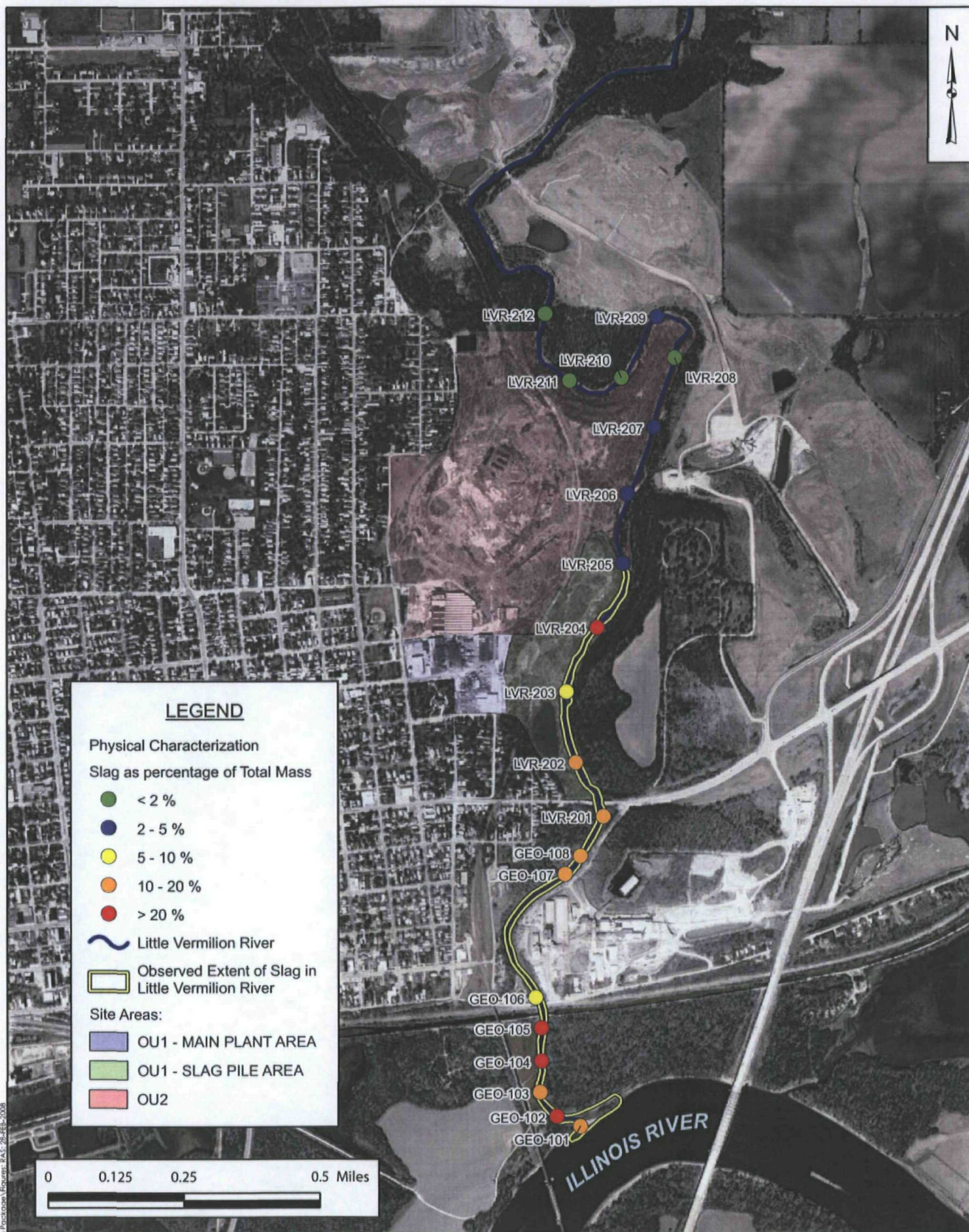
Little Vermilion River Surface Water Sampling and Physical Characterization Results

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Figure
10



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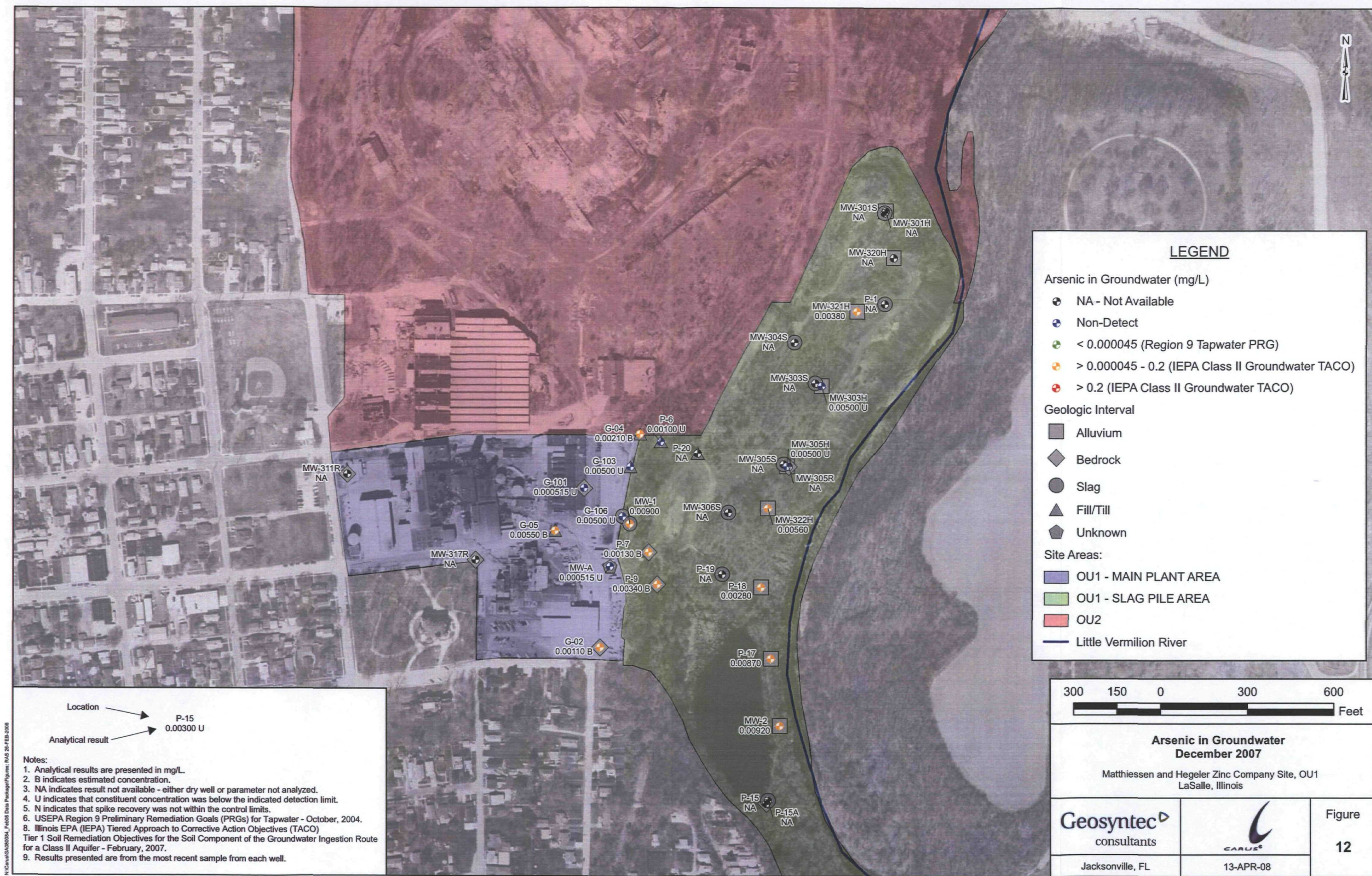
13-APR-08

**Physical Characterization of Slag
in the Little Vermilion River**

Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Figure

11



LEGEND

Arsenic in Groundwater (mg/L)

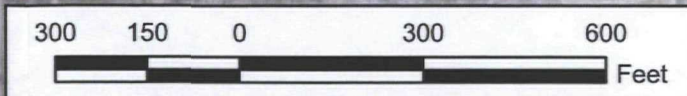
- NA - Not Available
- Non-Detect
- < 0.000045 (Region 9 Tapwater PRG)
- > 0.000045 - 0.2 (IEPA Class II Groundwater TACO)
- > 0.2 (IEPA Class II Groundwater TACO)

Geologic Interval

- Alluvium
- Bedrock
- Slag
- Fill/Till
- Unknown

Site Areas:

- OU1 - MAIN PLANT AREA
- OU1 - SLAG PILE AREA
- OU2
- Little Vermilion River



**Arsenic in Groundwater
December 2007**

Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

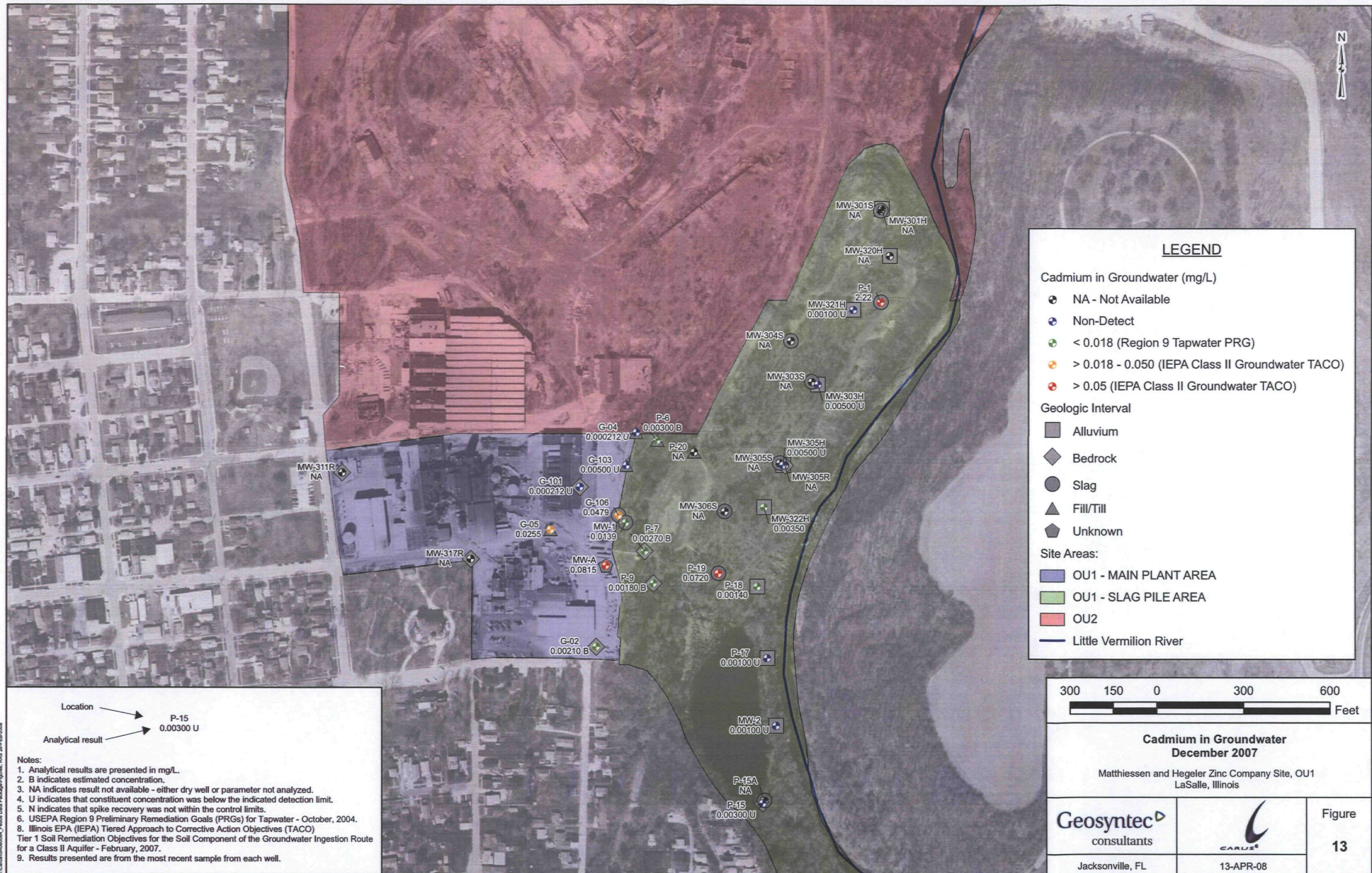
Geosyntec [®] consultants		Figure 12
Jacksonville, FL	13-APR-08	

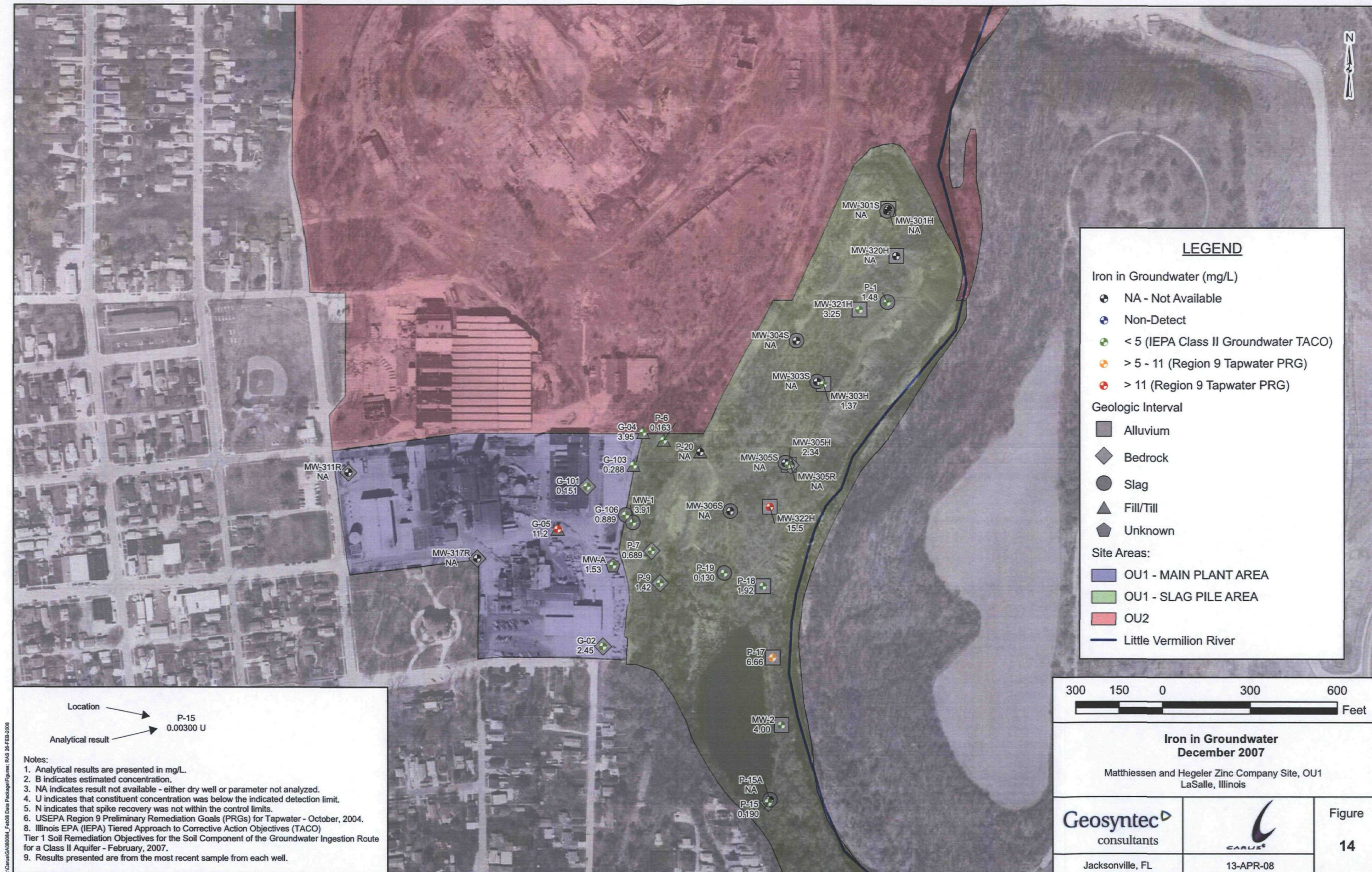
Location → P-15
Analytical result → 0.00300 U

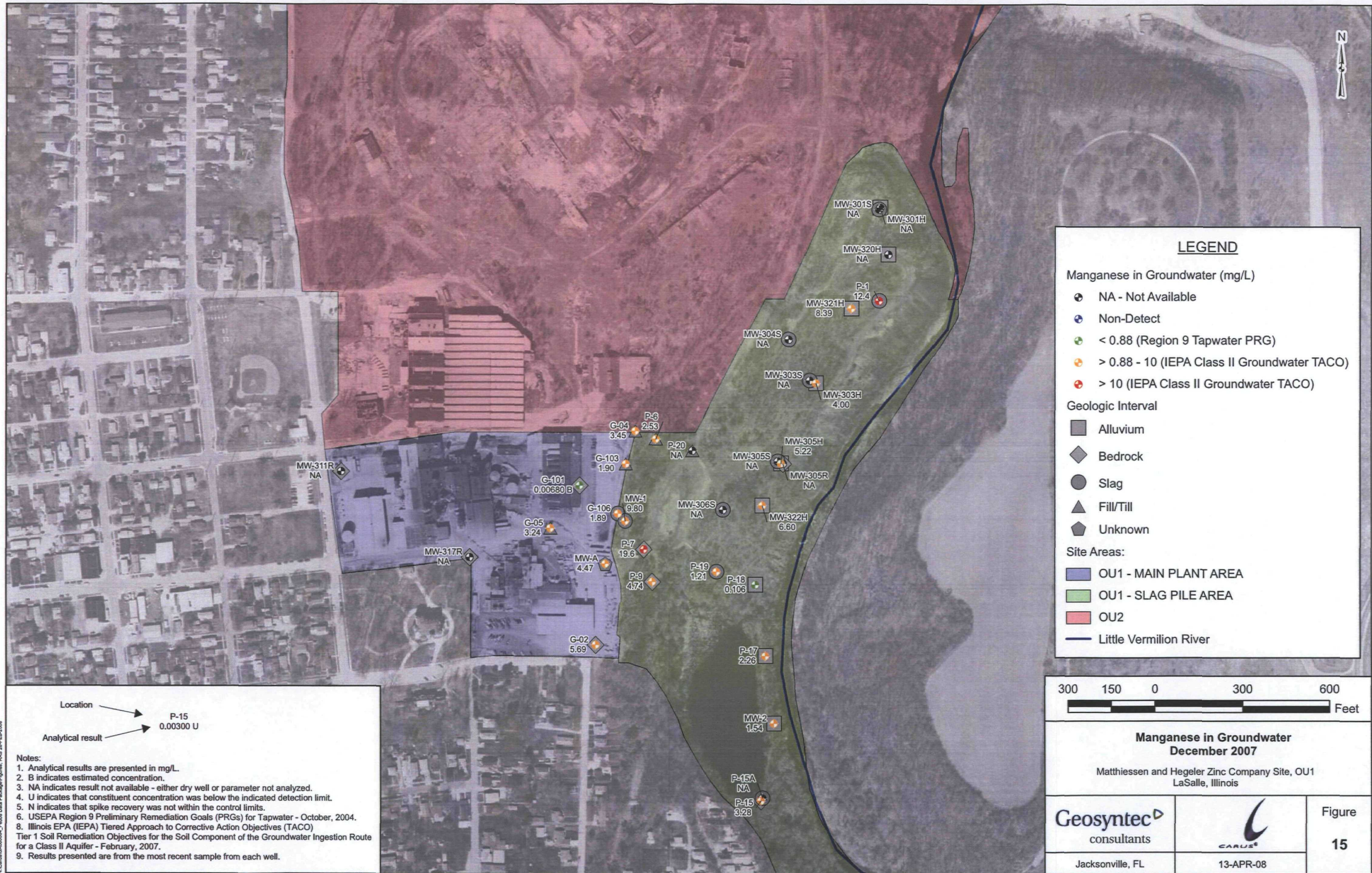
Notes:

1. Analytical results are presented in mg/L.
2. B indicates estimated concentration.
3. NA indicates result not available - either dry well or parameter not analyzed.
4. U indicates that constituent concentration was below the indicated detection limit.
5. N indicates that spike recovery was not within the control limits.
6. USEPA Region 9 Preliminary Remediation Goals (PRGs) for Tapwater - October, 2004.
7. Illinois EPA (IEPA) Tiered Approach to Corrective Action Objectives (TACO) Tier 1 Soil Remediation Objectives for the Soil Component of the Groundwater Ingestion Route for a Class II Aquifer - February, 2007.
8. Results presented are from the most recent sample from each well.

N:\Cavali\040804_Feb08 Data Package\Figures_RAS 28-FEB-2008







LEGEND

- Manganese in Groundwater (mg/L)
- NA - Not Available
 - Non-Detect
 - < 0.88 (Region 9 Tapwater PRG)
 - > 0.88 - 10 (IEPA Class II Groundwater TACO)
 - > 10 (IEPA Class II Groundwater TACO)

Geologic Interval

- Alluvium
- Bedrock
- Slag
- Fill/Till
- Unknown

Site Areas:

- OU1 - MAIN PLANT AREA
- OU1 - SLAG PILE AREA
- OU2
- Little Vermilion River



Manganese in Groundwater
December 2007

Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

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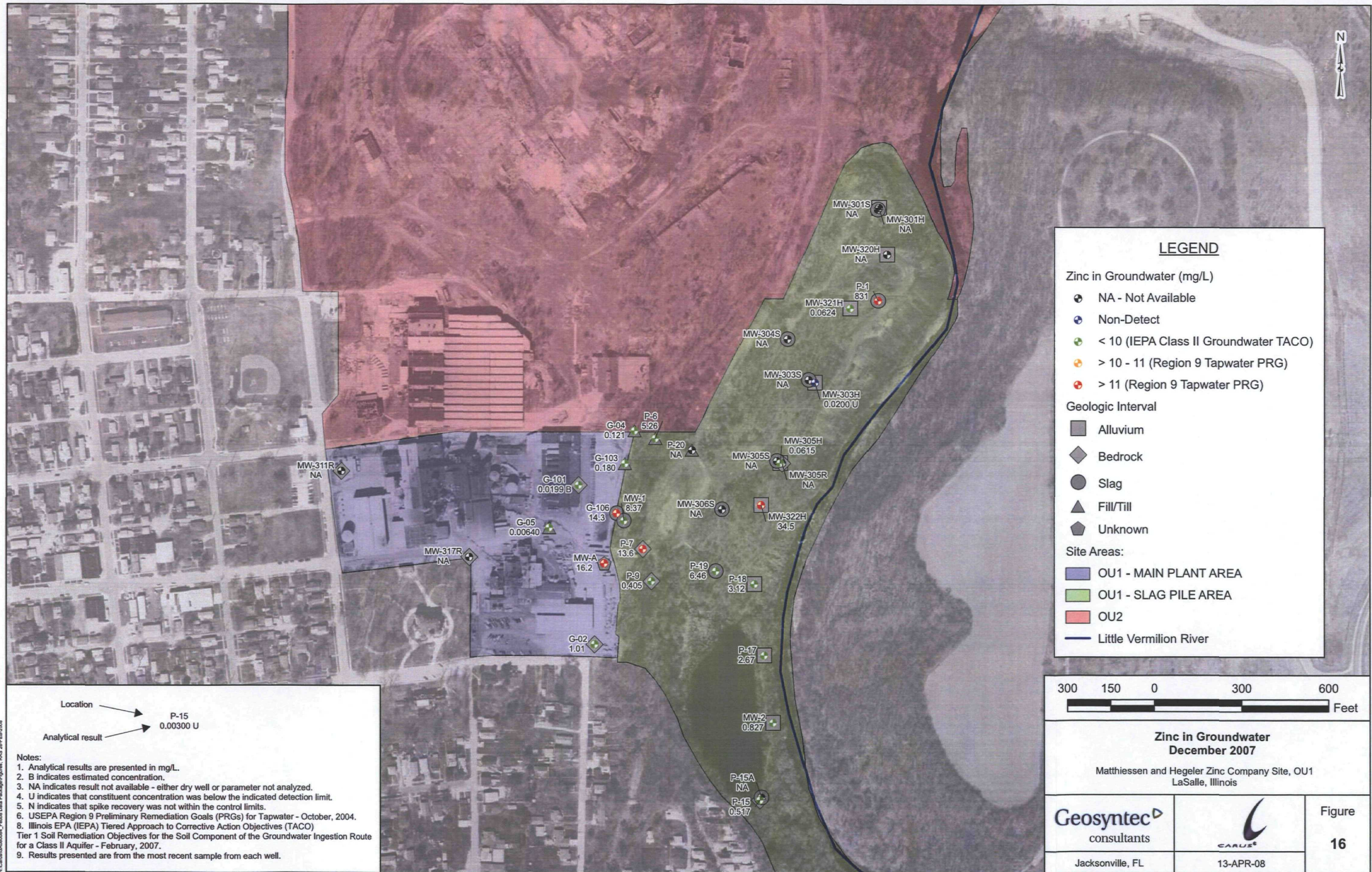
Jacksonville, FL

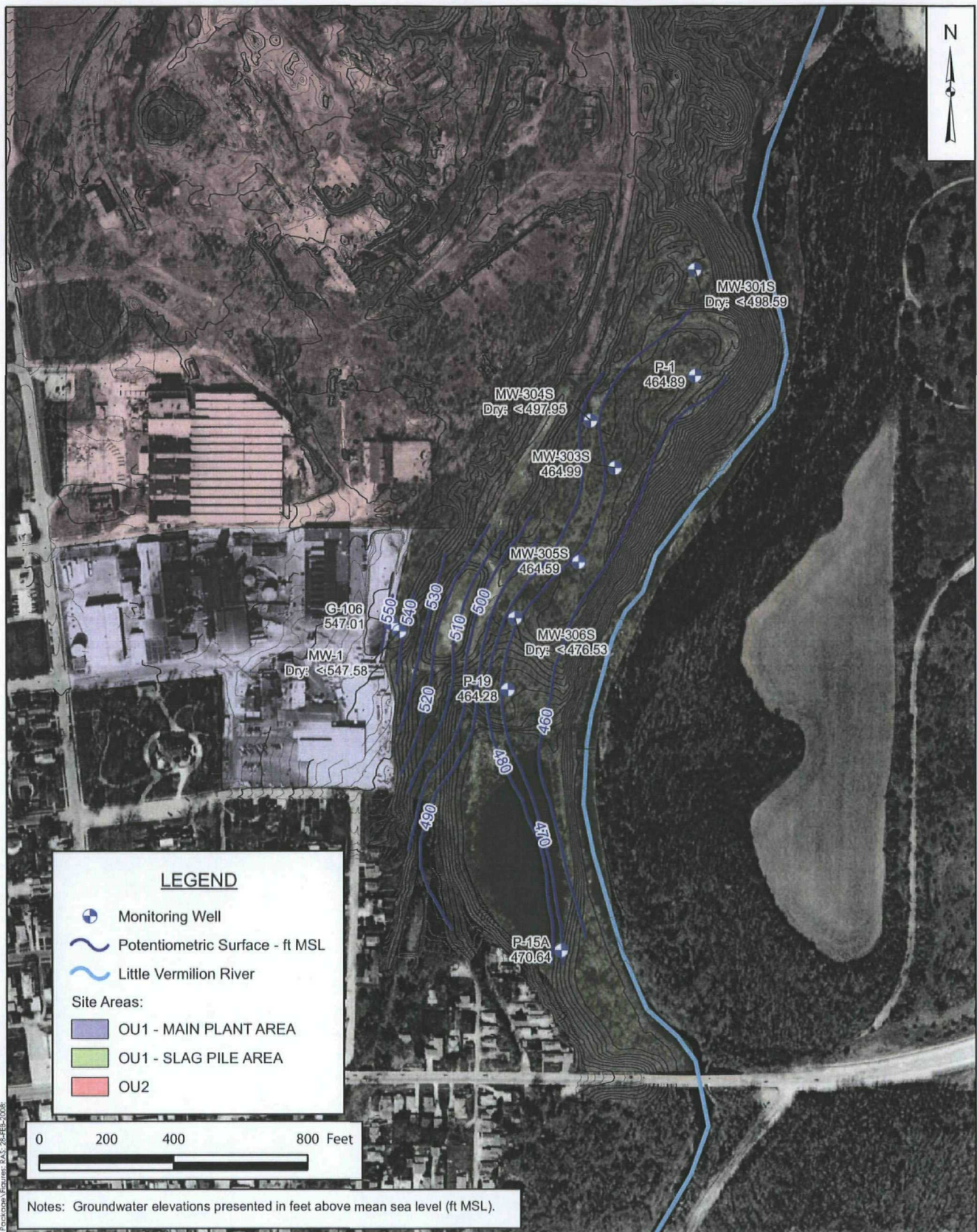
13-APR-08

Figure
15

Notes:

1. Analytical results are presented in mg/L.
2. B indicates estimated concentration.
3. NA indicates result not available - either dry well or parameter not analyzed.
4. U indicates that constituent concentration was below the indicated detection limit.
5. N indicates that spike recovery was not within the control limits.
6. USEPA Region 9 Preliminary Remediation Goals (PRGs) for Tapwater - October, 2004.
7. Illinois EPA (IEPA) Tiered Approach to Corrective Action Objectives (TACO) Tier 1 Soil Remediation Objectives for the Soil Component of the Groundwater Ingestion Route for a Class II Aquifer - February, 2007.
8. Results presented are from the most recent sample from each well.





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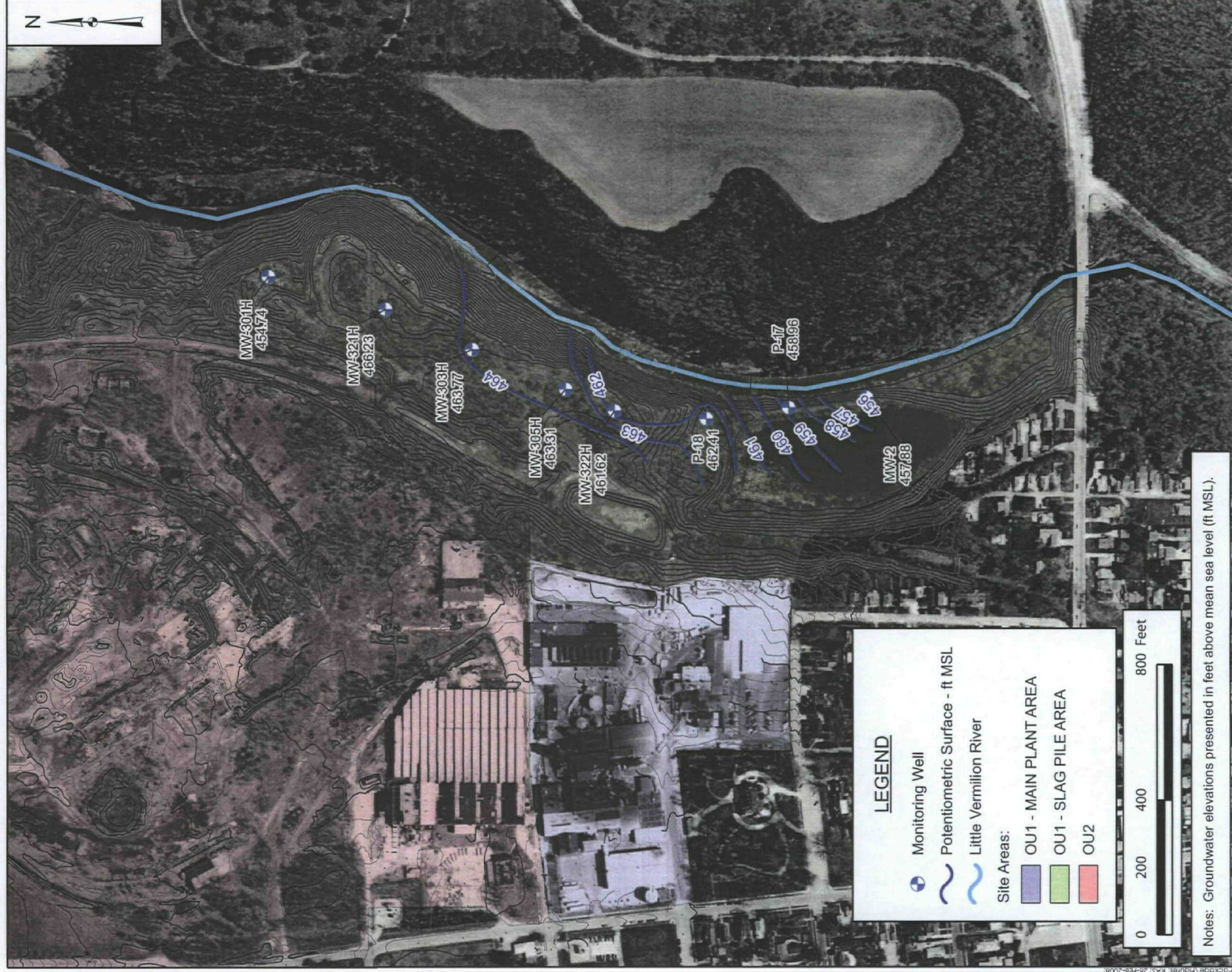
13-MAR-08

**Potentiometric Surface Map - Slag Wells
November 2007 - January 2008**

Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Figure

17



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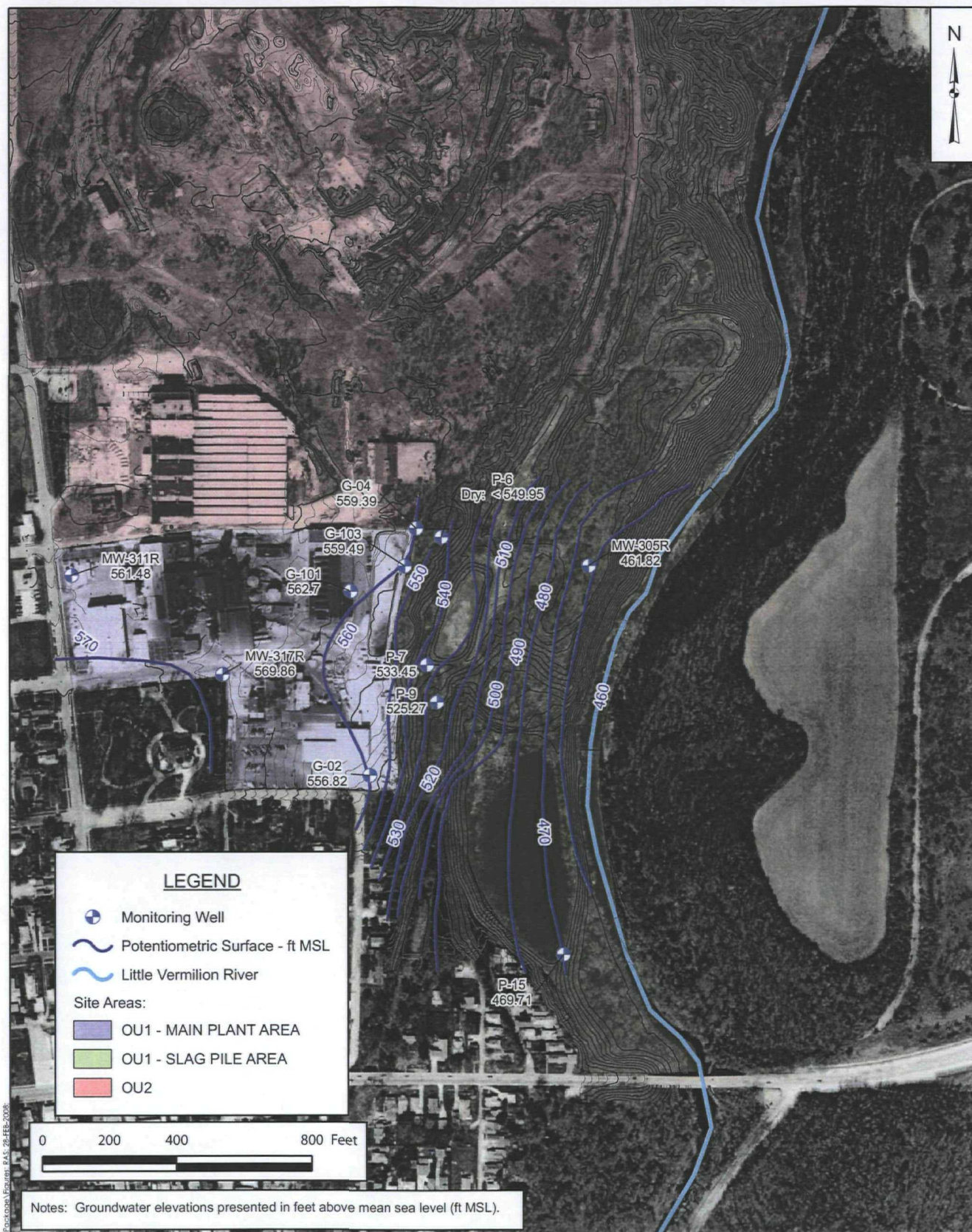
13-MAR-08

Potentiometric Surface Map - Alluvium Wells
November 2007 - January 2008

Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Figure

18



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13-MAR-08

**Potentiometric Surface Map - Rock Wells
November 2007 - January 2008**

Matthiessen and Hegeler Zinc Company Site, OU1
LaSalle, Illinois

Figure

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APPENDIX A

DATA VALIDATION REPORTS

Memorandum

TO: Nandra Weeks
DATE: March 5, 2008
FROM: Geosyntec Consultants QA/QC Group
SITE: Mattheissen and Hegeler Zinc Company Site, OU1
SUBJECT: Summary of Tier III Validation of analytical results for CAS Report R2740161

Introduction

This report summarizes the findings of the full validation of eighteen soil samples and one trip blank collected on behalf of the Mattheissen and Hegeler Zinc Company Site, OU1 project. These samples were collected on October 3, 2007. The samples were analyzed by Columbia Analytical Services, Inc. (CAS), Rochester, New York. The samples were analyzed for Volatile Organic Compounds by EPA Method 8260B, Semivolatile Organic Compounds by EPA Method 8270C, Organochlorine Pesticides by EPA Method 8081A, Polychlorinated Biphenyls (PCBs) by EPA Method 8082, Total Metals by EPA Methods 6020 and 6010B, Mercury by EPA Method 7471A, Cyanide by EPA Method 9012 and Percent Solids by Modified EPA Method 160.3.

The data were reviewed in accordance with the principles presented in *USEPA National Functional Guidelines for Laboratory Data Review, Organics* (EPA, 2005), *USEPA National Functional Guidelines for Laboratory Data Review, Inorganics* (EPA, 2004), and per the requirements of the QAPP, the laboratory standard operating procedures and the specified methods.

Data for the following samples were reviewed.

Field Sample ID	CAS Job Number
OU1-SS-SB316-2-4	1043069
OU1-SS-SB312-2-4	1043070
OU1-SS-SB311-0-4	1043071
OU1-SS-SB315-0-1	1043072
OU1-SS-SB319-0-1	1043076
OU1-SS-SB406	1043079
OU1-SS-SB406	1043080
OU1-MW-402	1043081

OU1-SS-SB316-0-1	1043108
OU1-SS-SB312-0-1	1043109
OU1-SS-SB311-2-4	1043110
OU1-SS-SB313-2-4	1043111
OU1-SS-SB313-0-1	1043112
OU1-SS-SB317-0-1	1043113
OU1-SS-SB317-2-4	1043114
OU1-SS-SB314-2-4	1043115
OU1-SS-SB314-0-1	1043116
OU1-SS-SB318-0-1	1043117
OU1-SS-SB318-2-4	1043118
OU1-SS-SB406	1043119
OU1-SS-SB315-2-4	1043120
OU1-SS-SB319-2-4	1043255

Matrix – soil and 1 aqueous trip blank

Executive Summary

All analyses were performed as requested on the chain of custody (COC). Sample OU1-SS-SB319-2-4 was received, but not listed on the COC for analysis. The sample was analyzed for metals by EPA Methods 6010B, 6020 and 7471A.

The laboratory narrative indicated that the samples were received outside of the temperature specifications of $4 \pm 2^{\circ}\text{C}$ at 8°C . No sample qualifications were made based on the sample receipt temperature.

All holding times were met, with the exception of the analysis of five soil samples for volatiles analysis, as discussed below.

1.0 Volatile Organic Compounds (EPA Method 8260B)

Full validation including recalculation was performed with the laboratory data for the analysis of volatile organic compounds (EPA Method 8260B). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ⊗ Holding Times and Preservation
- ✓ Calibrations
- ⊗ Internal Standards

- ⊗ Performance Check Sample
- ⊗ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ⊗ Matrix Spike/Matrix Spike Duplicate Sample
- ✓ Laboratory Control Samples
- ⊗ Compound Identification and Quantitation

1.1 Data Completeness

All analyses were performed as requested on the COC.

1.2 Holding Times and Preservation

Of the six samples analyzed for VOCs, one soil sample and the trip were analyzed within the 14 day technical holding time from date of collection for volatiles.

Five soil samples were not analyzed within the 14 day technical holding time from date of collection for volatiles, due to the tune standard initially analyzed with the samples not passing the method specified criteria. The tune standard, bromofluorobenzene (BFB), analyzed on 10/9/07, did not pass the method specified criteria due to an extra scan that was included in the initial evaluation. This error was not discovered in time to reanalyze the samples within the 14 day technical holding time. The samples were analyzed 23 days after sample collection. Therefore, all compounds detected in these five samples are J qualified as estimated; all compounds not detected in these five samples are UJ qualified as estimated below the reporting limits.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB316-2-4	Acetone	33 JB	33 J
	Benzene	3.6 J	3.6 J
	Bromodichloromethane	21 U	21 UJ
	Bromoform	21 U	21 UJ
	Bromomethane	21 U	21 UJ
	2-Butanone (MEK)	42 U	42 UJ
	Methyl-Tert-Butyl Ether	21 U	21 UJ
	Carbon Disulfide	42 U	42 UJ
	Carbon Tetrachloride	21 U	21 UJ
	Chlorobenzene	21 U	21 UJ
	Chloroethane	42 U	42 UJ
	Chloroform	21 U	21 UJ
	Chloromethane	21 U	21 UJ
	1,2-Dibromo-3-Chloropropane	21 U	21 UJ
	Cyclohexane	5.6 J	5.6 J
	Dibromochloromethane	21 U	21 UJ
	1,2-Dibromoethane	21 U	21 UJ
	1,3-Dichlorobenzene	21 U	21 UJ
	1,4-Dichlorobenzene	21 U	21 UJ
	1,2-Dichlorobenzene	21 U	21 UJ
	Dichlorodifluoromethane	21 U	21 UJ

	1,1-Dichloroethane	21 U	21 UJ
	1,2-Dichloroethane	21 U	21 UJ
	1,1-Dichloroethene	21 U	21 UJ
	Cis-1,2-Dichloroethene	21 U	21 UJ
	Trans-1,2-Dichloroethene	21 U	21 UJ
	1,2-Dichloropropane	21 U	21 UJ
	Cis-1,3-Dichloropropene	21 U	21 UJ
	Trans-1,3-Dichloropropene	21 U	21 UJ
	Ethylbenzene	1.6 J	1.6 J
	2-Hexanone	42 U	42 UJ
	Isopropylbenzene	21 U	21 UJ
	Methyl Acetate	42 U	42 UJ
	Methylcyclohexane	7.8 J	7.8 J
	Methylene Chloride	1.9 JB	1.9 J
	4-Methyl-2-Pentanone (MIBK)	42 U	42 UJ
	Styrene	21 U	21 UJ
	1,1,2,2-Tetrachloroethane	21 U	21 UJ
	Tetrachloroethene	21 U	21 UJ
	Toluene	5.8 J	5.8 J
	1,2,4-Trichlorobenzene	21 U	21 UJ
	1,1,1-Trichloroethane	21 U	21 UJ
	1,1,2-Trichloroethane	21 U	21 UJ
	Trichloroethene	21 U	21 UJ
	Trichlorofluoromethane	21 U	21 UJ
	1,1,2-Trichloro-1,2,2-Trifluoroethane	21 U	21 UJ
	Vinyl Chloride	21 U	21 UJ
	o-Xylene	21 U	21 UJ
	m+p-Xylene	2.9 J	2.9 J
OU1-SS-SB312-2-4	Acetone	10 JB	10 J
	Benzene	1.0 J	1.0 J
	Bromodichloromethane	7.3 U	7.3 UJ
	Bromoform	7.3 U	7.3 UJ
	Bromomethane	7.3 U	7.3 UJ
	2-Butanone (MEK)	15 U	15 UJ
	Methyl-Tert-Butyl Ether	7.3 U	7.3 UJ
	Carbon Disulfide	15 U	15 UJ
	Carbon Tetrachloride	7.3 U	7.3 UJ
	Chlorobenzene	7.3 U	7.3 UJ
	Chloroethane	15 U	15 UJ
	Chloroform	7.3 U	7.3 UJ
	Chloromethane	7.3 U	7.3 UJ
	1,2-Dibromo-3-Chloropropane	7.3 U	7.3 UJ
	Cyclohexane	0.63 J	0.63 J
	Dibromochloromethane	7.3 U	7.3 UJ
	1,2-Dibromoethane	7.3 U	7.3 UJ
	1,3-Dichlorobenzene	7.3 U	7.3 UJ

	1,4-Dichlorobenzene	7.3 U	7.3 UJ
	1,2-Dichlorobenzene	7.3 U	7.3 UJ
	Dichlorodifluoromethane	7.3 U	7.3 UJ
	1,1-Dichloroethane	7.3 U	7.3 UJ
	1,2-Dichloroethane	7.3 U	7.3 UJ
	1,1-Dichloroethene	7.3 U	7.3 UJ
	Cis-1,2-Dichloroethene	7.3 U	7.3 UJ
	Trans-1,2-Dichloroethene	7.3 U	7.3 UJ
	1,2-Dichloropropane	7.3 U	7.3 UJ
	Cis-1,3-Dichloropropene	7.3 U	7.3 UJ
	Trans-1,3-Dichloropropene	7.3 U	7.3 UJ
	Ethylbenzene	7.3 U	7.3 UJ
	2-Hexanone	15 U	15 UJ
	Isopropylbenzene	7.3 U	7.3 UJ
	Methyl Acetate	15 U	15 UJ
	Methylcyclohexane	0.75 J	0.75 J
	Methylene Chloride	0.70 JB	0.70 J
	4-Methyl-2-Pentanone (MIBK)	15 U	15 UJ
	Styrene	7.3 U	7.3 UJ
	1,1,2,2-Tetrachloroethane	7.3 U	7.3 UJ
	Tetrachloroethene	7.3 U	7.3 UJ
	Toluene	0.75 J	0.75 J
	1,2,4-Trichlorobenzene	7.3 U	7.3 UJ
	1,1,1-Trichloroethane	7.3 U	7.3 UJ
	1,1,2-Trichloroethane	7.3 U	7.3 UJ
	Trichloroethene	7.3 U	7.3 UJ
	Trichlorofluoromethane	7.3 U	7.3 UJ
	1,1,2-Trichloro-1,2,2-Trifluoroethane	7.3 U	7.3 UJ
	Vinyl Chloride	7.3 U	7.3 UJ
	o-Xylene	7.3 U	7.3 UJ
	m+p-Xylene	7.3 U	7.3 UJ
OU1-SS-SB311-0-4	Acetone	8.9 JB	8.9 J
	Benzene	6.2 U	6.2 UJ
	Bromodichloromethane	6.2 U	6.2 UJ
	Bromoform	6.2 U	6.2 UJ
	Bromomethane	6.2 U	6.2 UJ
	2-Butanone (MEK)	12 U	12 UJ
	Methyl-Tert-Butyl Ether	6.2 U	6.2 UJ
	Carbon Disulfide	0.63 J	0.63 J
	Carbon Tetrachloride	6.2 U	6.2 UJ
	Chlorobenzene	6.2 U	6.2 UJ
	Chloroethane	12 U	12 UJ
	Chloroform	6.2 U	6.2 UJ
	Chloromethane	6.2 U	6.2 UJ
	1,2-Dibromo-3-Chloropropane	6.2 U	6.2 UJ
	Cyclohexane	1.5 J	1.5 J

	Dibromochloromethane	6.2 U	6.2 UJ
	1,2-Dibromoethane	6.2 U	6.2 UJ
	1,3-Dichlorobenzene	6.2 U	6.2 UJ
	1,4-Dichlorobenzene	6.2 U	6.2 UJ
	1,2-Dichlorobenzene	6.2 U	6.2 UJ
	Dichlorodifluoromethane	6.2 U	6.2 UJ
	1,1-Dichloroethane	6.2 U	6.2 UJ
	1,2-Dichloroethane	6.2 U	6.2 UJ
	1,1-Dichloroethene	6.2 U	6.2 UJ
	Cis-1,2-Dichloroethene	6.2 U	6.2 UJ
	Trans-1,2-Dichloroethene	6.2 U	6.2 UJ
	1,2-Dichloropropane	6.2 U	6.2 UJ
	Cis-1,3-Dichloropropene	6.2 U	6.2 UJ
	Trans-1,3-Dichloropropene	6.2 U	6.2 UJ
	Ethylbenzene	0.43 J	0.43 J
	2-Hexanone	12 U	12 UJ
	Isopropylbenzene	6.2 U	6.2 UJ
	Methyl Acetate	12 U	12 UJ
	Methylcyclohexane	2.1 J	2.1 J
	Methylene Chloride	0.60 JB	0.60 J
	4-Methyl-2-Pentanone (MIBK)	12 U	12 UJ
	Styrene	6.2 U	6.2 UJ
	1,1,2,2-Tetrachloroethane	6.2 U	6.2 UJ
	Tetrachloroethene	6.2 U	6.2 UJ
	Toluene	0.93 J	0.93 J
	1,2,4-Trichlorobenzene	6.2 U	6.2 UJ
	1,1,1-Trichloroethane	6.2 U	6.2 UJ
	1,1,2-Trichloroethane	6.2 U	6.2 UJ
	Trichloroethene	6.2 U	6.2 UJ
	Trichlorofluoromethane	6.2 U	6.2 UJ
	1,1,2-Trichloro-1,2,2-Trifluoroethane	6.2 U	6.2 UJ
	Vinyl Chloride	6.2 U	6.2 UJ
	o-Xylene	6.2 U	6.2 UJ
	m+p-Xylene	6.2 U	6.2 UJ
OU1-SS-SB315-0-1	Acetone	34 JB	34 J
	Benzene	9.2 U	9.2 UJ
	Bromodichloromethane	9.2 U	9.2 UJ
	Bromoform	9.2 U	9.2 UJ
	Bromomethane	9.2 U	9.2 UJ
	2-Butanone (MEK)	1.9 J	1.9 J
	Methyl-Tert-Butyl Ether	9.2 U	9.2 UJ
	Carbon Disulfide	18 U	18 UJ
	Carbon Tetrachloride	9.2 U	9.2 UJ
	Chlorobenzene	9.2 U	9.2 UJ
	Chloroethane	18 U	18 UJ
	Chloroform	9.2 U	9.2 UJ
	Chloromethane	9.2 U	9.2 UJ

	1,2-Dibromo-3-Chloropropane	9.2 U	9.2 UJ
	Cyclohexane	9.2 U	9.2 UJ
	Dibromochloromethane	9.2 U	9.2 UJ
	1,2-Dibromoethane	9.2 U	9.2 UJ
	1,3-Dichlorobenzene	9.2 U	9.2 UJ
	1,4-Dichlorobenzene	9.2 U	9.2 UJ
	1,2-Dichlorobenzene	9.2 U	9.2 UJ
	Dichlorodifluoromethane	9.2 U	9.2 UJ
	1,1-Dichloroethane	9.2 U	9.2 UJ
	1,2-Dichloroethane	9.2 U	9.2 UJ
	1,1-Dichloroethene	9.2 U	9.2 UJ
	Cis-1,2-Dichloroethene	9.2 U	9.2 UJ
	Trans-1,2-Dichloroethene	9.2 U	9.2 UJ
	1,2-Dichloropropane	9.2 U	9.2 UJ
	Cis-1,3-Dichloropropene	9.2 U	9.2 UJ
	Trans-1,3-Dichloropropene	9.2 U	9.2 UJ
	Ethylbenzene	9.2 U	9.2 UJ
	2-Hexanone	18 U	18 UJ
	Isopropylbenzene	9.2 U	9.2 UJ
	Methyl Acetate	18 U	18 UJ
	Methylcyclohexane	9.2 U	9.2 UJ
	Methylene Chloride	9.2 U	9.2 UJ
	4-Methyl-2-Pentanone (MIBK)	18 U	18 UJ
	Styrene	9.2 U	9.2 UJ
	1,1,2,2-Tetrachloroethane	9.2 U	9.2 UJ
	Tetrachloroethene	9.2 U	9.2 UJ
	Toluene	9.2 U	9.2 UJ
	1,2,4-Trichlorobenzene	9.2 U	9.2 UJ
	1,1,1-Trichloroethane	9.2 U	9.2 UJ
	1,1,2-Trichloroethane	9.2 U	9.2 UJ
	Trichloroethene	9.2 U	9.2 UJ
	Trichlorofluoromethane	9.2 U	9.2 UJ
	1,1,2-Trichloro-1,2,2-Trifluoroethane	9.2 U	9.2 UJ
	Vinyl Chloride	9.2 U	9.2 UJ
	o-Xylene	9.2 U	9.2 UJ
	m+p-Xylene	9.2 U	9.2 UJ
OU1-SS-SB319-0-1	Acetone	530	530 J
	Benzene	38 U	38 UJ
	Bromodichloromethane	38 U	38 UJ
	Bromoform	38 U	38 UJ
	Bromomethane	38 U	38 UJ
	2-Butanone (MEK)	120	120 J
	Methyl-Tert-Butyl Ether	38 U	38 UJ
	Carbon Disulfide	11 J	11 J
	Carbon Tetrachloride	38 U	38 UJ
	Chlorobenzene	38 U	38 UJ

Chloroethane	77 U	77 UJ
Chloroform	38 U	38 UJ
Chloromethane	38 U	38 UJ
1,2-Dibromo-3-Chloropropane	38 U	38 UJ
Cyclohexane	6.7 J	6.7 J
Dibromochloromethane	38 U	38 UJ
1,2-Dibromoethane	38 U	38 UJ
1,3-Dichlorobenzene	38 U	38 UJ
1,4-Dichlorobenzene	38 U	38 UJ
1,2-Dichlorobenzene	38 U	38 UJ
Dichlorodifluoromethane	38 U	38 UJ
1,1-Dichloroethane	38 U	38 UJ
1,2-Dichloroethane	38 U	38 UJ
1,1-Dichloroethene	38 U	38 UJ
Cis-1,2-Dichloroethene	38 U	38 UJ
Trans-1,2-Dichloroethene	38 U	38 UJ
1,2-Dichloropropane	38 U	38 UJ
Cis-1,3-Dichloropropene	38 U	38 UJ
Trans-1,3-Dichloropropene	38 U	38 UJ
Ethylbenzene	38 U	38 UJ
2-Hexanone	22 J	22 J
Isopropylbenzene	38 U	38 UJ
Methyl Acetate	77 U	77 UJ
Methylcyclohexane	9.5 J	9.5 J
Methylene Chloride	3.4 JB	3.4 J
4-Methyl-2-Pentanone (MIBK)	17 J	17 J
Styrene	38 U	38 UJ
1,1,2,2-Tetrachloroethane	38 U	38 UJ
Tetrachloroethene	38 U	38 UJ
Toluene	4.6 J	4.6 J
1,2,4-Trichlorobenzene	38 U	38 UJ
1,1,1-Trichloroethane	38 U	38 UJ
1,1,2-Trichloroethane	38 U	38 UJ
Trichloroethene	38 U	38 UJ
Trichlorofluoromethane	38 U	38 UJ
1,1,2-Trichloro-1,2,2-Trifluoroethane	38 U	38 UJ
Vinyl Chloride	38 U	38 UJ
o-Xylene	38 U	38 UJ
m+p-Xylene	38 U	38 UJ

1.3 Calibrations

1.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the percent relative standard

deviation (%RSD) of the relative response factors (RRFs). For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

1.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria. The data package was missing the summary for 22 compounds in the CCV analyzed on 10/9/07. The missing page was sent by email.

1.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts, with the following exceptions. There were low internal standard recoveries, outside of the acceptance criteria, for d5-chlorobenzene and d4-1,4-dichlorobenzene in sample OU1-SS-SB406. Therefore, the concentrations of the associated undetected compounds in sample OU1-SS-SB406 are R qualified as rejected.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB406	Bromoform	6.3 U	6.3 R
	Chlorobenzene	6.3 U	6.3 R
	1,2-Dibromo-3-Chloropropane	6.3 U	6.3 R
	Dibromochloromethane	6.3 U	6.3 R
	1,2-Dibromoethane	6.3 U	6.3 R
	1,3-Dichlorobenzene	6.3 U	6.3 R
	1,4-Dichlorobenzene	6.3 U	6.3 R
	1,2-Dichlorobenzene	6.3 U	6.3 R
	Ethylbenzene	6.3 U	6.3 R
	2-Hexanone	13 U	13 R
	Isopropylbenzene	6.3 U	6.3 R
	Styrene	6.3 U	6.3 R
	1,1,2,2-Tetrachloroethane	6.3 U	6.3 R
	Tetrachloroethene	6.3 U	6.3 R
	1,2,4-Trichlorobenzene	6.3 U	6.3 R
	o-Xylene	6.3 U	6.3 R
	m+p-Xylene	6.3 U	6.3 R

1.5 Performance Check Samples

An instrument performance check sample (tune standard) was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for bromofluorobenzene (BFB), with the exception noted under section 1.2 Holding Times and Preservation. The tune standard, BFB, analyzed on 10/9/07, did not pass the method specified criteria due to an extra scan that was included in the initial evaluation. All of the affected samples, with the exception of the MS/MSD of sample OU1-SS-SB315-0-1, were reanalyzed. However, this error was not discovered in time to reanalyze the samples within the 14 day technical holding time.

1.6 Blanks

Acetone and methylene chloride were detected in the method blank associated with the soil samples, at estimated concentrations greater than the method detection limit (MDL) but less than the reporting limit (RL). Therefore, the estimated concentrations of acetone and methylene chloride in the associated samples that are less than the RL but greater than the MDL are U qualified as not detected at the RL. The concentrations of acetone in samples OU1-SS-SB316-2-4 and OU1-SS-SB315-0-1 are U qualified as not detected at an elevated RL due to the concentrations of acetone in the samples.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB316-2-4	Acetone	33 JB	33 U
	Methylene Chloride	1.9 JB	5 U
OU1-SS-SB312-2-4	Acetone	10 JB	20 U
	Methylene Chloride	0.70 JB	5 U
OU1-SS-SB311-0-4	Acetone	8.9 JB	20 U
	Methylene Chloride	0.60 JB	5 U
OU1-SS-SB315-0-1	Acetone	34 JB	34 U
	Methylene Chloride	9.2 JB	20 U
OU1-SS-SB319-0-1	Methylene Chloride	3.4 JB	20 U

In addition, acetone was detected in the trip blank, sample OU1-GW-MW-402, at an estimated concentration greater than the MDL but less than the RL. However, since the concentrations of acetone in the associated samples were either not detected or greater than two times the trip blank concentration, no additional sample qualifications were required.

1.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

1.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits.

1.9 Matrix Spike/Matrix Spike Duplicate Sample (MS/MSD)

Sample OU1-SS-SB315-0-1 was analyzed as the MS/MSD. All recoveries were within the laboratory control limits, with the following exception. Acetone had high

recovery outside of the laboratory control limits in the MS; therefore, the concentration of acetone in sample OU1-SS-SB315-0-1 is J qualified as estimated.

The following compounds had low recoveries outside of the laboratory control limits in the MS and/or the MSD: bromoform, chlorobenzene, dibromochloromethane, 1,2-dibromoethane, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichlorobenzene, cis-1,3-dichloropropene, trans-1,3-dichloropropene, 2-hexanone, styrene, toluene, 1,1,2-trichloroethane and o-xylene. Therefore, the undetected concentrations of these compounds in sample OU1-SS-SB315-0-1 are UJ qualified as estimated less than the RL.

The recoveries of 1,2,4-trichlorobenzene in the MS and MSD were less than 20% (14% and 12%, respectively). Therefore, the concentration of 1,2,4-trichlorobenzene in sample OU1-SS-SB315-0-1 is R qualified as rejected.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB315-0-1	Acetone	34 JB	34 J
	Bromoform	9.2 U	9.2 UJ
	Chlorobenzene	9.2 U	9.2 UJ
	Dibromochloromethane	9.2 U	9.2 UJ
	1,2-Dibromoethane	9.2 U	9.2 UJ
	1,3-Dichlorobenzene	9.2 U	9.2 UJ
	1,4-Dichlorobenzene	9.2 U	9.2 UJ
	1,2-Dichlorobenzene	9.2 U	9.2 UJ
	cis-1,3-Dichloropropene	9.2 U	9.2 UJ
	Trans-1,3-Dichloropropene	9.2 U	9.2 UJ
	2-Hexanone	18 U	18 UJ
	Styrene	9.2 U	9.2 UJ
	Toluene	9.2 U	9.2 UJ
	1,2,4-Trichlorobenzene	9.2 U	9.2 R
	1,1,2-Trichloroethane	9.2 U	9.2 UJ
	o-Xylene	9.2 U	9.2 UJ

1.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate, with the following exception. The laboratory indicated on the raw data for sample OU1-SS-SB312-2-4 that the detection of 2-butanone was below the MDL. The MDL for 2-butanone on the instrument used to analyze the sample is 0.76 ug/kg. Therefore, the calculated concentration of 2-butanone in sample OU1-SS-SB312-2-4 is above the MDL and less than the RL and J qualified as estimated.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB312-2-4	2-Butanone	15 U	1.0 J

2.0 Semivolatile Organic Compounds (EPA Method 8270C)

Full validation including recalculation was performed on the laboratory data for the analysis of semivolatile organic compounds (EPA Method 8270C). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ⊗ Calibrations
- ✓ Internal Standards
- ✓ Performance Check Sample
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ⊗ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

2.1 Data Completeness

All analyses were performed as requested on the COC.

2.2 Holding Times and Preservation

The samples for semivolatile analysis were extracted within the 14 day technical holding time from date of collection and analyzed with the 40 day technical holding time from date of extraction.

2.3 Calibrations

2.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the RRFs. For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

2.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria,

with the following exceptions. Benzaldehyde was outside of the method acceptance criteria in all CCVs; Hexachlorocyclopentadiene and 2,4-dinitrophenol were outside of the method acceptance criteria in one CCV. However, all three compounds were within the validation acceptance criteria, so no sample qualifications were required.

2.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts.

2.5 Performance Check Samples

An instrument performance check sample was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for decafluorotriphenylphosphine (DFTPP).

2.6 Blanks

There were no detections of the project compounds of concern in the laboratory method blanks.

2.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

2.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits, with the exception of benzaldehyde and di-n-octylphthalate which had high recoveries, outside of the laboratory control limits, in the LCS and/or LCSD. However, since benzaldehyde and di-n-octylphthalate were not detected in any of the samples, no sample qualifications were required.

2.9 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Sample OU1-SS-SB315-0-1 was analyzed as the MS/MSD. All compound recoveries were within the laboratory control limits, with the following exceptions. The recoveries of benzaldehyde were high and outside of the laboratory control limits. However, since benzaldehyde was not detected the sample, no sample qualifications were required.

Benzo(g,h,i)perylene and 2,4-dimethylphenol had low recoveries outside of the laboratory control limits in the MS and/or MSD. Therefore, the concentrations of benzo(g,h,i)perylene and 2,4-dimethylphenol in sample OU1-SS-SB315-0-1 are J qualified as estimated and UJ qualified as estimated less than the RL.

2,4-Dinitrophenol had no recovery in the MSD and 4,6-dinitro-2-methylphenol had low recoveries in the MS/MSD ($<10\%$; 8% and 7%, respectively). Therefore, the concentrations of 2,4-dinitrophenol and 4,6-dinitro-2-methylphenol in sample OU1-SS-SB315-0-1 are R qualified as rejected.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB315-0-1	Benzo(g,h,i)perylene	64 J	64 J
	2,4-Dimethylphenol	380 U	380 UJ
	2,4-Dinitrophenol	1900 U	1900 R
	4,6-Dinitro-2-methylphenol	1900 U	1900 R

2.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate

3.0 Organochlorine Pesticides (EPA Method 8081A)

Full validation including recalculation was performed on the laboratory data for the analysis of Organochlorine Pesticides (EPA Method 8081A). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ⊗ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

3.1 Data Completeness

All analyses were performed as requested on the COC.

3.2 Holding Times and Preservation

The samples for organochlorine pesticide analysis were extracted within the 14 day technical holding time from date of collection and analyzed with the 40 day technical holding time from date of extraction.

3.3 Calibrations

3.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the average

response factors (RFs). For all target analytes, the RSDs met the method criteria for all compounds.

3.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the percent differences (%D) between the average RFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

3.4 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

3.5 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

3.6 Laboratory Control Samples (LCS)

All LCS/LCS duplicate (LCSD) recoveries were within the laboratory control limits; however, all of the RPDs were high and outside of the laboratory control limits. No compounds were detected above the RL in any of the samples; therefore, no sample qualifications were applied to the data results.

There were low recoveries outside of the laboratory control limits in the LCS for delta-BHC, 4,4'-DDD and heptachlor epoxide; all LCSD recoveries were acceptable. Therefore, based on the low LCS recoveries, the undetected concentrations of delta-BHC, 4,4'-DDD and heptachlor epoxide in the samples are UJ qualified as estimated less than the RL.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB316-2-4	delta-BHC	1.9 U	1.9 UJ
	4,4'-DDD	3.8 U	3.8 UJ
	Heptachlor epoxide	1.9 U	1.9 UJ
OU1-SS-SB312-2-4	delta-BHC	2.0 U	2.0 UJ
	4,4'-DDD	3.9 U	3.9 UJ
	Heptachlor epoxide	2.0 U	2.0 UJ
OU1-SS-SB311-0-4	delta-BHC	2.1 U	2.1 UJ
	4,4'-DDD	4.2 U	4.2 UJ
	Heptachlor epoxide	2.1 U	2.1 UJ
OU1-SS-SB315-0-1	delta-BHC	1.9 U	1.9 UJ
	4,4'-DDD	3.8 U	3.8 UJ
	Heptachlor epoxide	1.9 U	1.9 UJ
OU1-SS-SB319-0-1	delta-BHC	2.0 U	2.0 UJ
	4,4'-DDD	3.9 U	3.9 UJ
	Heptachlor epoxide	2.0 U	2.0 UJ
OU1-SS-SB406	delta-BHC	1.9 U	1.9 UJ
	4,4'-DDD	3.8 U	3.8 UJ
	Heptachlor epoxide	1.9 U	1.9 UJ

3.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Sample OU1-SS-SB315-0-1 was analyzed as the MS/MSD. All compound recoveries were within the laboratory control limits, with the following exceptions. The recoveries of beta-BHC, beta-endosulfan and methoxychlor were high and outside of the laboratory control limits in the MS and/or MSD. However, since beta-BHC, beta-endosulfan and methoxychlor were not detected in sample OU1-SS-SB315-0-1, no sample qualifications were required. The MS/MSD forms originally sent in the data package identified the MS/MSD sample incorrectly. Corrected forms were sent by email.

3.8 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate

4.0 PCBs (EPA Method 8082)

Full validation including recalculation was performed on the laboratory data for the analysis of PCBs (EPA Method 8082). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ✓ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

4.1 Data Completeness

All analyses were performed as requested on the COC.

4.2 Holding Times and Preservation

The samples for organochlorine pesticide analysis were extracted within the 14 day technical holding time from date of collection and analyzed with the 40 day technical holding time from date of extraction.

4.3 Calibrations

4.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the average response factors (RFs). For all target analytes, the RSDs met the method criteria for all compounds.

4.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the percent differences (%D) between the average RFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

4.4 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

4.5 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

4.6 Laboratory Control Samples (LCS)

All LCS/LCS duplicate (LCSD) recoveries and RPDs were within the laboratory control limits.

4.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Sample OU1-SS-SB315-0-1 was analyzed as the MS/MSD. All compound recoveries were within the laboratory control limits

4.8 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate

5.0 Metals (EPA Methods 6020/6010B/7471A)

The soil samples were analyzed for the requested metals and Mercury (EPA 6020/6010B/7471A) following a total metals digestion and Mercury digestion. Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ⊗ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ⊗ Blanks
- ⊗ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ⊗ Laboratory Duplicate Samples
- ⊗ Serial Dilutions
- ⊗ Compound Identification and Quantitation

5.1 Data Completeness

All analyses were performed as requested on the COC. As noted earlier in this report, sample OU1-SS-SB319-2-4 was received, but not listed on the COC for analysis. The sample was analyzed for metals by EPA Methods 6010B, 6020 and 7471A.

5.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

5.3 Calibrations

5.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

5.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits.

5.3.3 CRDL (Detection Limit) Standard

The CRDL standards were within the control limits.

5.3.4 ICSA/ICSAB (Interference Check) Standards

The ICSA/ICSAB standards met all acceptance criteria.

5.4 Blanks

5.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria with the following exceptions; calcium, copper and magnesium were detected in the preparation blanks at estimated concentrations less than the RL, but greater than the instrument detection limits (IDL). However, since calcium, copper and magnesium were detected in the associated samples at concentrations greater than the RL, no sample qualifications were required.

5.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria with a few exceptions; several ICBs and CCBs had metal detections at estimated concentrations less than the RL, but greater than the IDLs. However, since the metals concentrations in the associated samples were greater than the RL, no sample qualifications were required.

5.5 Laboratory Control Samples (LCS/LCS Duplicate, LCSD)

All percent recoveries in the LCS/LCSDs were within the acceptance limits (75-125% recovery), with the exception of high recovery, outside of the acceptance limits for antimony. Therefore, the concentrations of antimony detected in the samples are J+ qualified as estimated with a high bias.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB316-2-4	Antimony	4.9 B	4.9 J+
OU1-SS-SB312-2-4	Antimony	2.2 B	2.2 J+
OU1-SS-SB311-0-4	Antimony	0.766 B	0.766 J+
OU1-SS-SB315-0-1	Antimony	20.2	20.2 J+
OU1-SS-SB319-0-1	Antimony	3.8 B	3.8 J+
OU1-SS-SB316-0-1	Antimony	11.2	11.2 J+
OU1-SS-SB312-0-1	Antimony	5.4 B	5.4 J+
OU1-SS-SB311-2-4	Antimony	2.2 B	2.2 J+
OU1-SS-SB313-2-4	Antimony	4.1 B	4.1 J+
OU1-SS-SB313-0-1	Antimony	1.2 B	1.2 J+
OU1-SS-SB317-2-4	Antimony	2.6 B	2.6 J+
OU1-SS-SB314-2-4	Antimony	4.4 B	4.4 J+
OU1-SS-SB314-0-1	Antimony	2.9 B	2.9 J+
OU1-SS-SB318-0-1	Antimony	5.2 B	5.2 J+
OU1-SS-SB318-2-4	Antimony	6.5 B	6.5 J+
OU1-SS-SB406	Antimony	3.5 B	3.5 J+
OU1-SS-SB315-2-4	Antimony	3.5 B	3.5 J+

5.6 Matrix Spike (MS)

Sample OU1-SS-SB315-2-4 was analyzed as the MS for the ICP/MS, ICP and Mercury analyses. The following compounds were outside of the control limits: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, selenium, vanadium and zinc. The following compounds were not qualified since the sample concentrations were greater than four times the spike concentrations: aluminum, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, vanadium and zinc. The concentrations of antimony, arsenic, beryllium, mercury and selenium in sample OU1-SS-SB315-2-4 are J- qualified as estimated with a low bias due to the low spike recoveries in the MS.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB315-2-4	Antimony	3.47 B	3.47 J-
	Arsenic	6.89	6.89 J-
	Beryllium	0.75 B	0.75 J-
	Mercury	0.528	0.528 J-
	Selenium	0.69 B	0.69 J-

5.7 Laboratory Duplicate Samples

Sample OU1-SS-SB315-2-4 was analyzed as the laboratory duplicate. The relative percent differences (RPD) were within the acceptance limits, with the following exceptions. Arsenic, barium, cadmium, calcium, lead, magnesium and manganese were all high and outside of the acceptance limits; therefore, the concentrations of arsenic, barium, cadmium, calcium, lead, magnesium and manganese in sample OU1-SS-SB315-2-4 are J qualified as estimated.

Sample	Metal	Laboratory Concentration (mg/kg)	Validation Concentration (mg/kg)
OU1-SS-SB315-2-4	Arsenic	6.89	6.89 J
	Barium	167	167 J
	Cadmium	18.5	18.5 J
	Calcium	87000	87000 J
	Lead	76.6	76.6 J
	Magnesium	21500	21500 J
	Manganese	3870	3870 J

5.8 Serial Dilutions

The percent differences for the compounds for the serial dilution for the total metals analysis of sample OU1-SS-SB313-2-4 were outside of the laboratory acceptance criteria for beryllium, selenium, thallium and vanadium; however, the beryllium, selenium and thallium concentrations are less than 50 times the IDL. Therefore, no sample qualifications are required. Since the vanadium concentration in sample OU1-SS-SB313-2-4 is greater than 50 times the IDL, the vanadium concentration in sample OU1-SS-SB313-2-4 is J qualified as estimated.

Sample	Metal	Laboratory Concentration (mg/kg)	Validation Concentration (mg/kg)
OU1-SS-SB313-2-4	Vanadium	13.22	13.22 J

5.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

The concentrations of some compounds in the samples were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the IDL. These concentrations are J qualified as estimated.

Sample	Metal	Laboratory Concentration (mg/kg)	Validation Concentration (mg/kg)
OU1-SS-SB316-2-4	Antimony	4.9 B	4.9 J
	Beryllium	0.458 B	0.458 J
	Silver	0.772 B	0.772 J

	Thallium	0.193 B	0.193 J
OU1-SS-SB312-2-4	Antimony	2.2 B	2.2 J
	Beryllium	0.598 B	0.598 J
	Cadmium	0.374 B	0.374 J
	Mercury	0.018 B	0.018 J
	Selenium	0.431 B	0.431 J
OU1-SS-SB311-0-4	Antimony	0.766 B	0.766 J
	Beryllium	0.183 B	0.183 J
	Cadmium	0.682 B	0.682 J
	Selenium	0.491 B	0.491 J
OU1-SS-SB315-0-1	Arsenic	33.6 B	33.6 J
	Nickel	20.5 B	20.5 J
	Thallium	0.264 B	0.264 J
OU1-SS-SB319-0-1	Antimony	3.8 B	3.8 J
	Beryllium	0.828 B	0.828 J
	Cadmium	0.649 B	0.649 J
	Selenium	1.0 B	1.0 J
	Thallium	0.121 B	0.121 J
OU1-SS-SB316-0-1	Thallium	0.380 B	0.380 J
OU1-SS-SB312-0-1	Antimony	5.4 B	5.4 J
	Beryllium	0.634 B	0.634 J
	Cobalt	5.1 B	5.1 J
	Selenium	0.493 B	0.493 J
	Thallium	0.190 B	0.190 J
OU1-SS-SB311-2-4	Antimony	2.2 B	2.2 J
	Beryllium	0.304 B	0.304 J
	Cadmium	0.665 B	0.665 J
	Mercury	0.034 B	0.034 J
	Selenium	0.396 B	0.396 J
	Thallium	0.331 B	0.331 J
OU1-SS-SB313-2-4	Antimony	4.1 B	4.1 J
	Arsenic	0.213 B	0.213 J
	Beryllium	1.0 B	1.0 J
	Cadmium	0.562 B	0.562 J
	Mercury	0.008 B	0.008 J
	Selenium	0.601 B	0.601 J
	Thallium	0.095 B	0.095 J
OU1-SS-SB313-0-1	Antimony	1.2 B	1.2 J
	Beryllium	0.26 B	0.26 J
	Cadmium	0.695 B	0.695 J
	Selenium	0.450 B	0.450 J
	Thallium	0.050 B	0.050 J
OU1-SS-SB317-0-1	Beryllium	0.090 B	0.090 J
	Cadmium	0.283 B	0.283 J
	Selenium	0.440 B	0.440 J
OU1-SS-SB317-2-4	Antimony	2.6 B	2.6 J
	Beryllium	0.585 B	0.585 J
	Mercury	0.026 B	0.026 J
	Selenium	0.691 B	0.691 J
	Thallium	0.193 B	0.193 J

OU1-SS-SB314-2-4	Antimony	4.4 B	4.4 J
	Beryllium	0.556 B	0.556 J
	Selenium	0.472 B	0.472 J
	Thallium	0.161 B	0.161 J
OU1-SS-SB314-0-1	Antimony	2.9 B	2.9 J
	Beryllium	0.590 B	0.590 J
	Cadmium	0.874 B	0.874 J
	Mercury	0.020 B	0.020 J
	Selenium	0.439 B	0.439 J
	Thallium	0.101 B	0.101 J
OU1-SS-SB318-0-1	Antimony	5.2 B	5.2 J
	Beryllium	0.818 B	0.818 J
	Selenium	2.2 B	2.2 J
	Silver	0.276 B	0.276 J
	Thallium	0.217 B	0.217 J
OU1-SS-SB318-2-4	Antimony	6.5 B	6.5 J
	Thallium	0.559 B	0.559 J
OU1-SS-SB406	Antimony	3.5 B	3.5 J
	Beryllium	0.677 B	0.677 J
	Mercury	0.026 B	0.026 J
	Selenium	0.857 B	0.857 J
	Thallium	0.170 B	0.170 J
OU1-SS-SB315-2-4	Antimony	3.5 B	3.5 J
	Beryllium	0.752 B	0.752 J
	Selenium	0.693 B	0.693 J
	Thallium	0.122 B	0.122 J
OU1-SS-SB319-2-4	Arsenic	0.264 B	0.264 J
	Beryllium	0.409 B	0.409 J
	Cadmium	0.566 B	0.566 J
	Mercury	0.008 B	0.008 J
	Selenium	0.496 B	0.496 J

6.0 Cyanide (EPA Methods 9012) and Percent Solids (Modified Method 160.3)

The soil samples were analyzed for Cyanide (EPA Method 9012). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPS and the quality of the data reported. The following summarizes the results of this review. In addition, the percent solids data was reviewed and found to be acceptable.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ Laboratory Control Samples

- ✓ Matrix Spike/Matrix Spike Duplicate Samples
- ✓ Laboratory Duplicate Samples

6.1 Data Completeness

All analyses were performed as requested on the COC.

6.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

6.3 Calibrations

6.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for Cyanide analysis.

6.3.2 Continuing Calibration Verification (CCV)

The percent recoveries in all associated CCVs were within the QC acceptance limits for Cyanide.

6.4 Blanks

6.4.1 Preparation (Method) Blank

The preparation blank met the acceptance criteria; Cyanide was not detected in the method blank.

6.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICB and CCBs met the acceptance criteria; no Cyanide was detected in either the ICB or CCBs.

6.5 Laboratory Control Sample (LCS)

The percent recovery in the LCS was within the acceptance limits (85-115% recovery).

6.6 Matrix Spike (MS)

Sample OU1-SS-SB315-0-1 was analyzed as the MS. The MS recovery was within the laboratory control limits (30-162%).

6.7 Laboratory Duplicate Samples

Sample OU1-SS-SB315-0-1 was analyzed as the laboratory duplicate. Cyanide was not detected in the original sample or the duplicate.

ATTACHMENT A
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by GeoSyntec's Data Review Team

DATA QUALIFIER DEFINITIONS

- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Memorandum

TO: Nandra Weeks

DATE: March 5, 2008

FROM: Geosyntec Consultants QA/QC Group

SITE: Mattheissen and Hegeler Zinc Company Site, OU1

SUBJECT: Summary of Tier III Validation of analytical results for CAS Report R2740248

Introduction

This report summarizes the findings of the full validation of 10 soil samples and one trip blank collected on behalf of the Mattheissen and Hegeler Zinc Company Site, OU1 project. These samples were collected on October 9, 2007. The samples were analyzed by Columbia Analytical Services, Inc. (CAS), Rochester, New York. The samples were analyzed for Volatile Organic Compounds by EPA Method 8260B, Semivolatile Organic Compounds by EPA Method 8270C, Organochlorine Pesticides by EPA Method 8081A, Polychlorinated Biphenyls (PCBs) by EPA Method 8082, Total Metals by EPA Methods 6020 and 6010B, Mercury by EPA Method 7471A, Metals by EPA Methods 6020, 6010 and 7470A following EPA Method 1312 Synthetic Precipitation Leaching Procedure (SPLP), Cyanide by EPA Method 9012, pH by EPA Method 9045 and Percent Solids by Modified EPA Method 160.3.

The data were reviewed in accordance with the principles presented in *USEPA National Functional Guidelines for Laboratory Data Review, Organics* (EPA, 2005), *USEPA National Functional Guidelines for Laboratory Data Review, Inorganics* (EPA, 2004), and per the requirements of the QAPP, the laboratory standard operating procedures and the specified methods.

Data for the following samples were reviewed.

CAS Job No.	Client ID
1044839	OU1-SS-SB302-0-1
1044840	OU1-SS-SB302-10.5-11.5
1044841	OU1-SS-SB302-12-13
1044842	OU1-SS-SB301-0-1
1044843	OU1-SS-SB301-44-50
1044844	OU1-SS-SB301-40-41
1044846	OU1-SS-SB304-0-1

1044848	OU1-SS-SB304-58-59
1044849	OU1-SS-SB304-59-60
1044860	OU1-SS-SB302-10.5-11.5
1044861	OU1-SS-SB301-0-1
1044862	OU1-SS-SB304-59-60
1044863	OU1-SS-SB302-10.5-11.5
1044865	OU1-SS-SB301-0-1
1044866	OU1-SS-SB304-59-60
1044868	OU1-SS-SB302-10.5-11.5
1044869	OU1-SS-SB301-0-1
1044870	OU1-SS-SB304-59-60
1044871	OU1-SS-SB402
1044872	OU1-SS-SB301-0-1
1044873	OU1-SS-SB302-10.5-11.5
1044874	OU1-SS-SB301-0-1
1044875	OU1-SS-SB304-0-1

Matrix – soil and 1 aqueous trip blank

Executive Summary

All analyses were performed as requested on the chain of custody (COC). The dates of sample collection and date samples were relinquished on the COC only included the month and day; the year was not included in the date. It was assumed, based on the date of sample receipt at the laboratory, that the year was 2007.

All holding times were met.

1.0 Volatile Organic Compounds (EPA Method 8260B)

Full validation including recalculation was performed with the laboratory data for the analysis of volatile organic compounds (EPA Method 8260B). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Internal Standards
- ✓ Performance Check Sample
- ⊗ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ⊗ Matrix Spike/Matrix Spike Duplicate Sample

- ✓ Laboratory Control Samples
- ✓ Compound Identification and Quantitation

1.1 Data Completeness

All analyses were performed as requested on the COC.

1.2 Holding Times and Preservation

All samples were analyzed within the 14 day technical holding time from date of collection for volatiles.

1.3 Calibrations

1.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the percent relative standard deviation (%RSD) of the relative response factors (RRFs). For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

1.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

1.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts

1.5 Performance Check Samples

An instrument performance check sample (tune standard) was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for bromofluorobenzene (BFB).

1.6 Blanks

Acetone, carbon disulfide, methylene chloride and toluene were detected in the method blank associated with the soil samples, at estimated concentrations greater than the method detection limit (MDL) but less than the reporting limit (RL). Therefore, based on the estimated concentrations of acetone, carbon disulfide, methylene chloride and toluene in the associated samples that are greater than the MDL but less than the RL, the concentrations of acetone, carbon disulfide, methylene chloride and toluene in the associated samples are U qualified as not detected at the RL.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB302-10.5-11.5	Acetone	20 JB	32 U
	Methylene chloride	0.51 JB	8.0 U
	Toluene	3.7 JB	8.0 U
OU1-SS-SB301-0-1	Acetone	26 JB	32 U
OU1-SS-SB304-59-60	Acetone	22 JB	26 U
	Carbon Disulfide	2.2 JB	13 U
	Methylene chloride	0.45 JB	6.4 U
	Toluene	4.4 J	6.4 U

Sample OU1-SS-SB402 is mislabeled and is the trip blank (the QAPP specifies the trip blank ID to be identified as OU1-SW-MW402). No compounds were detected in the trip blank above the MDL.

1.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

1.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits.

1.9 Matrix Spike/Matrix Spike Duplicate Sample (MS/MSD)

A MS/MSD pair was not analyzed.

1.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

2.0 Semivolatile Organic Compounds (EPA Method 8270C)

Full validation including recalculation was performed on the laboratory data for the analysis of semivolatile organic compounds (EPA Method 8270C). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Internal Standards
- ✓ Performance Check Sample
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ⊗ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate

✓ Compound Identification and Quantitation

2.1 Data Completeness

All analyses were performed as requested on the COC.

2.2 Holding Times and Preservation

The samples for semivolatile analysis were extracted within the 14 day technical holding time from date of collection and analyzed with the 40 day technical holding time from date of extraction.

2.3 Calibrations

2.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the RRFs. For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

2.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

2.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts.

2.5 Performance Check Samples

An instrument performance check sample was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for decafluorotriphenylphosphine (DFTPP).

2.6 Blanks

There were no detections of the project compounds of concern in the laboratory method blanks.

2.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

2.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits, with the exception of benzaldehyde and di-n-octylphthalate which had high recoveries, outside of the laboratory control limits, in the LCS and/or LCSD. However, since benzaldehyde and

di-n-octylphthalate were not detected in any of the samples, no sample qualifications were required.

2.9 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Sample OU1-SS-SB304-59-60 was analyzed as the MS/MSD. All compound recoveries were within the laboratory control limits, with the following exception. The recoveries of benzaldehyde in the MS/MSD were high and outside of the laboratory control limits. However, since benzaldehyde was not detected the sample, no sample qualifications were required.

2.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate

3.0 **Organochlorine Pesticides (EPA Method 8081A)**

Full validation including recalculation was performed on the laboratory data for the analysis of Organochlorine Pesticides (EPA Method 8081A). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

3.1 Data Completeness

All analyses were performed as requested on the COC.

3.2 Holding Times and Preservation

The samples for organochlorine pesticide analysis were extracted within the 14 day technical holding time from date of collection and analyzed with the 40 day technical holding time from date of extraction.

3.3 Calibrations

3.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the average response factors (RFs). For all target analytes, the RSDs met the method criteria for all compounds.

3.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the percent differences (%D) between the average RFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

3.4 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

3.5 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

3.6 Laboratory Control Samples (LCS)

All LCS/LCS duplicate (LCSD) recoveries and RPDs were within the laboratory control limits.

3.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

A MS/MSD pair was not analyzed.

3.8 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate. It was noted that J qualified concentrations (sample concentrations between the MDL and RL) were not reported by the laboratory.

4.0 **PCBs (EPA Method 8082)**

Full validation including recalculation was performed on the laboratory data for the analysis of PCBs (EPA Method 8082). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

4.1 Data Completeness

All analyses were performed as requested on the COC.

4.2 Holding Times and Preservation

The samples for PCB analysis were extracted within the 14 day technical holding time from date of collection and analyzed with the 40 day technical holding time from date of extraction.

4.3 Calibrations

4.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the average response factors (RFs). For all target analytes, the RSDs met the method criteria for all compounds.

4.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the percent differences (%D) between the average RFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

4.4 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

4.5 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

4.6 Laboratory Control Samples (LCS)

All LCS/LCS duplicate (LCSD) recoveries and RPDs were within the laboratory control limits.

4.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

A MS/MSD pair was not analyzed.

4.8 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

5.0 Metals (EPA Methods 6020/6010B/7470A)

The soil samples were analyzed for the requested metals and Mercury (EPA 6020/6010B/7471A) following a total metals digestion and Mercury digestion. Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ⊗ Blanks
- ⊗ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ⊗ Laboratory Duplicate Samples
- ⊗ Serial Dilutions
- ⊗ Compound Identification and Quantitation

5.1 Data Completeness

All analyses were performed as requested on the COC.

5.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

5.3 Calibrations

5.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

5.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits, with the following exception. Beryllium recovery was low and outside of the QC acceptance limits in the CCVs bracketing the analyses of samples OU1-SS-SB302-0-1, OU1-SS-SB302-12-13, OU1-SS-SB301-40-41, OU1-SS-SB304-58-59 and OU1-SS-SB304-59-60; therefore, the concentrations of beryllium in these samples are J- qualified as estimated with a low bias.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB302-0-1	Beryllium	1.6	1.6 J-
OU1-SS-SB302-12-13	Beryllium	0.229 B	0.229 J-
OU1-SS-SB301-40-41	Beryllium	1.6	1.6 J-
OU1-SS-SB304-58-59	Beryllium	2.1	2.1 J-
OU1-SS-SB304-59-60	Beryllium	0.455 B	0.455 J-

5.3.3 CRDL (Detection Limit) Standard

The CRDL standards were within the control limits, with the exception of high manganese recovery outside of the method acceptance limits in the closing CRDL standard. However, since the samples associated with this closing CRDL had manganese concentrations greater than two times the RL, no sample qualifications are required.

5.3.4 ICSA/ICSAB (Interference Check) Standards

The ICSA/ICSAB standards met all acceptance criteria.

5.4 Blanks

5.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria with the following exceptions; aluminum, barium, chromium, lead, manganese and zinc were detected in the preparation blank at estimated concentrations less than the RL, but greater than the instrument detection limits (IDL). However, since aluminum, barium, chromium, lead, manganese and zinc were detected in the associated samples at concentrations greater than the RL, no sample qualifications were required.

5.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria with a few exceptions; several ICBs and CCBs had metal detections at estimated concentrations less than the RL, but greater than the IDLs. However, since the metals concentrations in the associated samples were greater than the RL, no sample qualifications were required.

5.5 Laboratory Control Samples (LCS)

All percent recoveries in the LCS were within the acceptance limits, with the exception of high recovery outside of the control limits for antimony. However, since antimony was either not detected or detected less than the RL, but greater than the IDL, no sample qualifications were required.

5.6 Matrix Spike (MS)

An MS was not analyzed

5.7 Laboratory Duplicate Samples

A laboratory duplicate was not analyzed.

5.8 Serial Dilutions

The percent differences for the compounds for the serial dilution for the total metals analysis of sample OU1-SS-SB302-12-13 were outside the laboratory acceptance criteria for beryllium, potassium, selenium and sodium; however, the beryllium, potassium, selenium and sodium concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required.

The serial dilution form in the data package indicates that the calcium, manganese and sodium recoveries are 7%, yet flagged the results with E, indicating the serial dilution failed. A corrected form was emailed.

5.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

The concentrations of some compounds in the samples were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the instrument detection limit. These concentrations are J qualified as estimated.

Sample	Metal	Laboratory Concentration (mg/kg)	Validation Concentration (mg/kg)
OU1-SS-SB302-0-1	Antimony	1.0 B	1.0 J
	Selenium	4.2 B	4.2 J
	Thallium	0.283 B	0.283 J
OU1-SS-SB02-10.5-11.5	Beryllium	0.742 B	0.742 J
	Mercury	0.024 B	0.024 J
	Thallium	0.488 B	0.488 J
OU1-SS-SB302-12-13	Beryllium	0.229 B	0.229 J
	Thallium	0.262 B	0.262 J
OU1-SS-SB301-0-1	Antimony	1.8 B	1.8 J
	Chromium	18.2 B	18.2 J
	Nickel	39.9 B	39.9 J
OU1-SS-SB301-44-50	Beryllium	1.5 B	1.5 J
	Cadmium	0.703 B	0.703 J
	Mercury	0.016 B	0.016 J
	Selenium	0.590 B	0.590 J
	Thallium	0.298 B	0.298 J
OU1-SS-SB301-40-41	Antimony	2.5 B	2.5 J
	Arsenic	45.5 B	45.5 J
	Nickel	41.1 B	41.1 J
	Potassium	157 B	157 J
	Silver	0.179 B	0.179 J
OU1-SS-SB301-40-41	Antimony	6.5B	6.5 J
	Beryllium	1.3 B	1.3 J
	Chromium	19.4 B	19.4 J
	Cobalt	10.4 B	10.4 J
	Selenium	4.4 B	4.4 J
	Thallium	0.622 B	0.622 J
OU1-SS-SB304-58-59	Thallium	0.064 B	0.064 J
OU1-SS-SB304-59-60	Beryllium	0.455 B	0.455 J
	Mercury	0.005 B	0.005 J
	Thallium	0.091 B	0.091 J

6.0 SPLP Metals (EPA Methods 1312/6020/6010B/7470A)

The soil samples were analyzed for the requested metals and Mercury (EPA 6020/6010B/7470A) following a Synthetic Precipitation Leaching Procedure (SPLP). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of

review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ⊗ Blanks
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ✓ Laboratory Duplicate Samples
- ✓ Serial Dilutions
- ⊗ Compound Identification and Quantitation

6.1 Data Completeness

All analyses were performed as requested on the COC. The SPLP extraction log was requested from the laboratory and was sent by email.

6.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

6.3 Calibrations

6.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

6.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits.

6.3.3 CRDL Standard

The CRDL standards were within the control limits.

6.3.4 ICSA/ICSAB Standards

The ICSA/ICSAB met all acceptance criteria.

6.4 Blanks

6.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria with the following exceptions; arsenic, chromium, iron, lead and zinc were detected in the preparation blank at estimated concentrations less than the RL, but greater than the IDL. Therefore, based on the associated samples' arsenic, chromium, iron, lead and zinc concentrations, the estimated concentrations in the samples are U qualified as not detected at the RL.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-SS-SB02-10.5-11.5	Chromium	0.799 B	3.0 U
	Lead	0.100 B	1.0 U
OU1-SS-SB301-0-1	Arsenic	0.477 B	1.0 U
	Chromium	0.987 B	3.0 U
	Iron	43.9 B	100 U
OU1-SS-SB304-0-1	Chromium	2.1 B	3.0 U

6.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria with a few exceptions; several ICBs and CCBs had metal detections at estimated concentrations less than the RL, but greater than the IDLs. However, since the metals concentrations in the associated samples were greater than the RL, no sample qualifications were required.

6.5 Laboratory Control Samples (LCS)

All percent recoveries in the LCS were within the acceptance limits.

6.6 Matrix Spike (MS)

A MS/MSD pair was not analyzed.

6.7 Laboratory Duplicate Samples

A sample duplicate was not analyzed.

6.8 Serial Dilutions

The percent differences for the compounds for the serial dilution for the SPLP analysis of sample OU1-SS-SB304-0-1 were outside of the laboratory acceptance criteria for chromium, copper, magnesium, potassium and vanadium; however, since the concentrations of these metals are less than 50 times the IDL. Therefore, no sample qualifications are required.

6.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

The concentrations of some compounds in the samples were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the IDL. These concentrations are J qualified as estimated.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-SS-SB302-10.5-11.5	Chromium	0.799 B	0.799 J
	Copper	0.626 B	0.626 J
	Lead	0.100 B	0.100 J

	Magnesium	811 B	811 J
	Selenium	0.900 B	0.900 J
	Vanadium	0.445 B	0.445 J
OU1-SS-SB301-0-1	Aluminum	41.8 B	41.8 J
	Arsenic	0.477 B	0.477 J
	Chromium	0.987 B	0.987 J
	Cobalt	0.342 B	0.342 J
	Iron	43.9 B	43.9 J
	Magnesium	923 B	923 J
	Manganese	1.1 B	1.1 J
	Mercury	0.141 B	0.141 J
	Nickel	1.2 B	1.2 J
	Potassium	562 B	562 J
	Vanadium	0.348 B	0.348 J
OU1-SS-SB304-0-1	Chromium	2.1 B	2.1 J
	Cobalt	0.286 B	0.286 J
	Magnesium	681 B	681 J
	Mercury	0.081 B	0.081 J
	Nickel	1.5 B	1.5 J
	Potassium	256 B	256 J

7.0 Cyanide (EPA Method 9012) and Percent Solids (Modified Method 160.3)

The soil samples were analyzed for cyanide (EPA Method 9012) and percent solids (EPA Modified Method 160.3). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review. In addition, the percent solids data was reviewed and found to be acceptable.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ Laboratory Control Sample
- ⊗ Matrix Spike Sample
- ⊗ Laboratory Duplicate Sample

7.1 Data Completeness

All analyses were performed as requested on the COC.

7.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

7.3 Calibrations

7.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for Cyanide analysis.

7.3.2 Continuing Calibration Verification (CCV)

The percent recoveries in all associated CCVs were within the QC acceptance limits for Cyanide.

7.4 Blanks

7.4.1 Preparation (Method) Blank

The preparation blank met the acceptance criteria; Cyanide was not detected in the method blank.

7.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICB and CCBs met the acceptance criteria; no Cyanide was detected in either the ICB or CCBs.

7.5 Laboratory Control Sample (LCS)

The cyanide percent recovery in the LCS was within the acceptance limits (85-115% recovery).

7.6 Matrix Spike (MS)

A MS was not analyzed.

7.7 Laboratory Duplicate Samples

A laboratory duplicate was not analyzed.

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ATTACHMENT A
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by GeoSyntec's Data Review Team

DATA QUALIFIER DEFINITIONS

- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Memorandum

TO: Nandra Weeks
DATE: March 5, 2008
FROM: Geosyntec Consultants QA/QC Group
SITE: Mattheissen and Hegeler Zinc Company Site, OU1
SUBJECT: Summary of Tier III Validation of analytical results for CAS Report R2740269

Introduction

This report summarizes the findings of the full validation of four soil samples and one trip blank collected on behalf of the Mattheissen and Hegeler Zinc Company Site, OU1 project. These samples were collected on October 11, 2007. The samples were analyzed by Columbia Analytical Services, Inc. (CAS), Rochester, New York. The samples were analyzed for Volatile Organic Compounds by EPA Method 8260B, Semivolatile Organic Compounds by EPA Method 8270C, Organochlorine Pesticides by EPA Method 8081A, Polychlorinated Biphenyls (PCBs) by EPA Method 8082, Total Metals by EPA Methods 6020 and 6010, Mercury by EPA Method 7471A, Metals by EPA Methods 6020, 6010 and 7470A following EPA Method 1312 Synthetic Precipitation Leaching Procedure (SPLP), Cyanide by EPA Method 9012, pH by EPA Method 9045 and Percent Solids by Modified EPA Method 160.3.

The data were reviewed in accordance with the principles presented in *USEPA National Functional Guidelines for Laboratory Data Review, Organics* (EPA, 2005), *USEPA National Functional Guidelines for Laboratory Data Review, Inorganics* (EPA, 2004), and per the requirements of the QAPP, the laboratory standard operating procedures and the specified methods.

Data for the following samples were reviewed.

CAS Job No.	Client ID
1045269	OU1-SS-SB303-0-1
1045270	OU1-SS-SB303-85-86
1045271	OU1-SS-SB303-89-90
1045272	OU1-SS-SB303-108-109
1045274	OU1-SS-SB303-0-1
1045275	OU1-SS-SB303-89-90
1045276	OU1-SS-SB303-108-109

1045277	OU1-SS-SB303-89-90
1045278	OU1-SS-SB303-89-90
1045279	OU1-SS-SB303-89-90
1045285	OU1-SS-SB402

Matrix – soil and 1 aqueous trip blank

Executive Summary

All analyses were performed as requested on the chain of custody (COC).

All holding times were met.

1.0 Volatile Organic Compounds (EPA Method 8260B)

Full validation including recalculation was performed with the laboratory data for the analysis of volatile organic compounds (EPA Method 8260B). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Internal Standards
- ✓ Performance Check Sample
- ⊗ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ⊗ Matrix Spike/Matrix Spike Duplicate Sample
- ✓ Laboratory Control Samples
- ✓ Compound Identification and Quantitation

1.1 Data Completeness

All analyses were performed as requested on the chain of custody (COC).

1.2 Holding Times and Preservation

All samples were analyzed within the 14 day technical holding time from date of collection for volatiles.

1.3 Calibrations

1.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the percent relative standard deviation (%RSD) of the relative response factors (RRFs). For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria

for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

1.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

1.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts

1.5 Performance Check Samples

An instrument performance check sample (tune standard) was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for bromofluorobenzene (BFB).

1.6 Blanks

Acetone, carbon disulfide, methylene chloride and toluene were detected in the method blank associated with the soil sample, at estimated concentrations greater than the method detection limit (MDL) but less than the reporting limit (RL). No sample qualifications were required for acetone and carbon disulfide due to the high concentrations of these compounds in the associated sample. However, the concentrations of methylene chloride and toluene in sample OU1-SS-SB303-89-90 are U qualified as not detected at the RL.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB303-89-90	Methylene Chloride	0.85 JB	5.0 U
	Toluene	0.94 JB	5.0 U

Sample OU1-SS-SB402 is mislabeled and is the trip blank; the QAPP specifies the trip blank ID to be identified as OU1-SW-MW402. Acetone and methylene chloride were detected in the trip blank at estimated concentrations greater than the MDL but less than the RL. Due to the high concentration of acetone in the associated sample, no sample qualification is required for acetone. The concentration of methylene chloride in sample OU1-SS-SB303-89-90 is U qualified as not detected at the RL due to the estimated concentration of methylene chloride in the sample greater than the MDL but less than the RL.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB303-89-90	Methylene Chloride	0.85 JB	5.0 U

1.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

1.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits.

1.9 Matrix Spike/Matrix Spike Duplicate Sample (MS/MSD)

A MS/MSD pair was not analyzed.

1.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

2.0 Semivolatile Organic Compounds (EPA Method 8270C)

Full validation including recalculation was performed on the laboratory data for the analysis of semivolatile organic compounds (EPA Method 8270C). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Internal Standards
- ✓ Performance Check Sample
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ⊗ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

2.1 Data Completeness

All analyses were performed as requested on the COC.

2.2 Holding Times and Preservation

The samples for semivolatile analysis were extracted within the 14 day technical holding time from date of collection and analyzed within the 40 day technical holding time from date of extraction.

2.3 Calibrations

2.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the RRFs. For all

target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

2.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

2.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts.

2.5 Performance Check Samples

An instrument performance check sample was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for decafluorotriphenylphosphine (DFTPP).

2.6 Blanks

There were no detections of the project compounds of concern in the laboratory method blanks.

2.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

2.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits, with the exception of benzaldehyde and di-n-octylphthalate which had high recoveries, outside of the laboratory control limits, in the LCS and/or LCSD. However, since benzaldehyde and di-n-octylphthalate were not detected in any of the samples, no sample qualifications were required.

2.9 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

A MS/MSD pair was not analyzed.

2.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate

3.0 Organochlorine Pesticides (EPA Method 8081A)

Full validation including recalculation was performed on the laboratory data for the analysis of Organochlorine Pesticides (EPA Method 8081A). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

3.1 Data Completeness

All analyses were performed as requested on the COC.

3.2 Holding Times and Preservation

The samples for organochlorine pesticide analysis were extracted within the 14 day technical holding time from date of collection and analyzed with the 40 day technical holding time from date of extraction.

3.3 Calibrations

3.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the average response factors (RFs). For all target analytes, the RSDs met the method criteria for all compounds.

3.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the percent differences (%D) between the average RFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

3.4 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

3.5 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

3.6 Laboratory Control Samples (LCS)

All LCS/LCS duplicate (LCSD) recoveries and RPDs were within the laboratory control limits.

3.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

A MS/MSD pair was not analyzed.

3.8 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate

4.0 PCBs (EPA Method 8082)

Full validation including recalculation was performed on the laboratory data for the analysis of PCBs (EPA Method 8082). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

4.1 Data Completeness

All analyses were performed as requested on the COC.

4.2 Holding Times and Preservation

The samples for PCB analysis were extracted within the 14 day technical holding time from date of collection and analyzed with the 40 day technical holding time from date of extraction.

4.3 Calibrations

4.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the average response factors (RFs). For all target analytes, the RSDs met the method criteria for all compounds.

4.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the percent differences (%D) between the average RFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

4.4 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

4.5 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

4.6 Laboratory Control Samples (LCS)

All LCS/LCS duplicate (LCSD) recoveries and RPDs were within the laboratory control limits.

4.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

A MS/MSD pair was not analyzed.

4.8 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

5.0 Metals (EPA Methods 6020/6010B/7470A)

The soil samples were analyzed for the requested metals and Mercury (EPA 6020/6010B/7471A) following a total metals digestion and Mercury digestion. Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ⊗ Blanks
- ⊗ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ⊗ Laboratory Duplicate Samples
- ⊗ Serial Dilutions
- ⊗ Compound Identification and Quantitation

5.1 Data Completeness

All analyses were performed as requested on the COC.

5.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

5.3 Calibrations

5.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

5.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits, with the following exception. Beryllium was low and outside of the QC acceptance limits in the CCVs bracketing the analysis of sample OU1-SS-SB303-89-90; therefore, the concentration of beryllium in sample OU1-SS-SB303-89-90 is J- qualified as estimated with a low bias.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
SS-SB303-89-90	Beryllium	2.0	2.0 J-

5.3.3 CRDL (Detection Limit) Standard

The CRDL standards were within the control limits, with the exception of low iron recovery outside the method acceptance limits in the closing CRDL standard. However, since the samples associated with this closing CRDL had iron concentrations greater than two times the RL, no sample qualifications are required.

5.3.4 ICSA/ICSAB (Interference Check) Standards

The ICSA/ICSAB standards met all acceptance criteria.

5.4 Blanks

5.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria with the following exceptions; barium, calcium, chromium, lead, sodium and zinc were detected in the preparation blank at estimated concentrations less than the RL but greater than the instrument detection limits (IDL). However, since barium, calcium, chromium, lead, sodium and zinc were detected in the associated samples at concentrations greater than the RL, no sample qualifications were required.

5.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria with a few exceptions; several ICBs and CCBs had metal detections at estimated concentrations less than the RL, but greater than the IDLs. However, since the metals concentrations in the associated samples were greater than the RLs, no sample qualifications were required.

5.5 Laboratory Control Samples (LCS)

All percent recoveries in the LCS were within the acceptance limits.

5.6 Matrix Spike (MS)

Sample OU1-SS-SB303-0-1 was analyzed as the MS for the ICP/MS, ICP and Mercury analyses. The following compound recoveries were outside of the control limits: aluminum, calcium, iron, magnesium, manganese, mercury, potassium, and zinc. The compounds were not qualified since the sample concentrations were greater than four times the spike concentrations.

5.7 Laboratory Duplicate Samples

Laboratory duplicates were prepared for all of the samples in the data set. The relative percent differences (RPDs) were within the acceptance limits (0-20%) for all compounds but zinc, which was high and outside the acceptance limits; therefore, the concentrations of zinc in the samples are J qualified as estimated.

Sample	Metal	Laboratory Concentration (mg/kg)	Validation concentration (mg/kg)
OU1-SS-SB303-0-1	Zinc	1970	1970 J
OU1-SS-SB303-85-86	Zinc	6010	6010 J
OU1-SS-SB303-89-90	Zinc	8890	8890 J
OU1-SS-SB303-108-109	Zinc	123	123 J

5.8 Serial Dilutions

The percent differences for the serial dilution for the total metals analysis of sample OU1-SS-SB303-0-1 were outside the laboratory acceptance criteria for antimony, magnesium, silver and sodium; however, the antimony and magnesium concentrations are less than 50 times the IDL. Therefore no sample qualifications are required. Since the silver and sodium concentrations in sample OU1-SS-SB303-0-1 are greater than 50 times the IDL, the silver and sodium concentrations in sample OU1-SS-SB303-0-1 are J qualified as estimated.

Sample	Metal	Laboratory Concentration (mg/kg)	Validation concentration (mg/kg)
OU1-SS-SB303-0-1	Silver	11.1	11.1 J
	Sodium	370	370 J

5.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

The concentrations of some compounds in the samples were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the IDL. These concentrations are J qualified as estimated.

Sample	Metal	Laboratory Concentration (mg/kg)	Validation concentration (mg/kg)
OU1-SS-SB303-0-1	Beryllium	5.1 B	5.1 J
	Chromium	17.6 B	17.6 J
OU1-SS-SB03-85-86	Antimony	9.6 B	9.6 J
	Arsenic	15.5 B	15.5 J
	Beryllium	5.9 B	5.9 J
	Chromium	9.1 B	9.1 J
	Mercury	0.007 B	0.007 J
	Nickel	16.8 B	16.8 J
	Potassium	2110 B	2110 J
	Sodium	413 B	413 J
OU1-SS-SB303-89-90	Antimony	7.5 B	7.5 J
	Thallium	0.251 B	0.251 J
OU1-SS-SB303-108-109	Antimony	1.2 B	1.2 J
	Beryllium	0.245 B	0.245 J
	Thallium	0.092 B	0.092 J

6.0 SPLP Metals (EPA Methods 1312/6020/6010B/7470A)

The soil samples were analyzed for the requested metals and Mercury (EPA 6020/6010B/7470A) following a Synthetic Precipitation Leaching Procedure (SPLP). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ⊗ Blanks
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ✓ Laboratory Duplicate Samples
- ✓ Serial Dilutions
- ⊗ Compound Identification and Quantitation

6.1 Data Completeness

All analyses were performed as requested on the COC. The SPLP extraction logs were not included in the data package. The SPLP extraction log was requested from the laboratory and was sent by email.

6.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

6.3 Calibrations

6.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

6.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits.

6.3.3 CRDL Standard

The detection limit (CRDL) standards were within the control limits.

6.3.4 ICSA/ICSAB Standards

The interference check standards (ICSA/ICSAB) met all acceptance criteria.

6.4 Blanks

6.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria with the following exceptions; arsenic, chromium, iron, lead, and zinc were detected in the preparation blank at estimated concentrations less than the RL but greater than the IDL; however, since arsenic, iron, lead, and zinc were detected in the associated samples at concentrations greater than the RL, no sample qualifications were required. Chromium in sample OU1-SS-SB303-89-90 is U qualified at the RL since it is detected at an estimated concentration less than the RL but greater than the IDL.

Sample	Metal	Laboratory Concentration (ug/L)	Validation concentration (ug/L)
OU1-SS-SB303-89-90	Chromium	0.710 B	1.0 U

6.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria with a few exceptions; several ICBs and CCBs had metal detections at concentrations less than the RL, but greater than the IDLs. However, since the metals concentrations in the associated samples were greater than the RLs, no sample qualifications were required.

6.5 Laboratory Control Samples (LCS)

All percent recoveries in the LCS were within the acceptance limits.

6.6 Matrix Spike (MS)

A MS was not analyzed.

6.7 Laboratory Duplicate Samples

A sample duplicate was not analyzed.

6.8 Serial Dilutions

The percent differences for the compounds for the serial dilution for the SPLP analysis of sample OU1-SS-SB303-108-109 were outside the laboratory acceptance criteria for arsenic, cobalt, copper, lead, magnesium, selenium and vanadium; however, since the concentrations of these metals are less than 50 times the IDL, no sample qualifications are required.

6.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

The concentrations of some compounds in the samples were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the IDL. These concentrations are J qualified as estimated.

Sample	Metal	Laboratory Concentration (ug/L)	Validation concentration (ug/L)
OU1-SS-SB303-89-90	Arsenic	0.445 B	0.445 J
	Copper	0.954 B	0.954 J
	Lead	0.250 B	0.250 J
	Mercury	0.018 B	0.018 J
	Vanadium	0.607 B	0.607 J
OU1-SS-SB303-108-109	Arsenic	0.432 B	0.432 J
	Cobalt	0.171 B	0.171 J
	Lead	0.394 B	0.394 J
	Manganese	3.4 B	3.4 J
	Mercury	0.021 B	0.021 J
	Potassium	299 B	299 J
	Selenium	0.457 B	0.457 J

7.0 Cyanide (EPA Method 9012), pH (EPA Method 9045) and Percent Solids (Modified Method 160.3)

The soil samples were analyzed for cyanide (EPA Method 9012), pH (EPA Method 9045) and percent solids (EPA Modified Method 160.3). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review. In addition, the percent solids data was reviewed and found to be acceptable.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ Laboratory Control Sample
- ✓ Matrix Spike Sample
- ✓ Laboratory Duplicate Sample

7.1 Data Completeness

All analyses were performed as requested on the chain-of-custody records.

7.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

7.3 Calibrations

7.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for Cyanide analysis.

The pH meter was calibrated appropriately.

7.3.2 Continuing Calibration Verification (CCV)

The percent recoveries in all associated CCVs were within the QC acceptance limits for Cyanide. The pH CCVs were appropriate to the method.

7.4 Blanks

7.4.1 Preparation (Method) Blank

The preparation blank met the acceptance criteria; Cyanide was not detected in the method blank.

7.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICB and CCBs met the acceptance criteria; no Cyanide was detected in either the ICB or CCBs.

7.5 Laboratory Control Sample (LCS)

The cyanide percent recovery in the LCS was within the acceptance limits (85-115% recovery).

7.6 Matrix Spike (MS)

A batch MS was analyzed; recovery was within the acceptance limits.

7.7 Laboratory Duplicate Samples

A batch laboratory duplicate was analyzed; cyanide was not detected in either the original or the duplicate sample.

ATTACHMENT A
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by GeoSyntec's Data Review Team

DATA QUALIFIER DEFINITIONS

- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Memorandum

TO: Nandra Weeks

DATE: March 5, 2008

FROM: Geosyntec Consultants QA/QC Group

SITE: Mattheissen and Hegeler Zinc Company Site, OU1

SUBJECT: Summary of Tier III Validation of analytical results for CAS Report R2740355

Introduction

This report summarizes the findings of the full validation of 3 soil samples, one equipment blank, one trip blank and one field blank collected on behalf of the Mattheissen and Hegeler Zinc Company Site, OU1 project. These samples were collected on October 16, 2007. The samples were analyzed by Columbia Analytical Services, Inc. (CAS), Rochester, New York. The samples were analyzed for Volatile Organic Compounds by EPA Method 8260B, Semivolatile Organic Compounds by EPA Method 8270C, Total Metals by EPA Methods 6020 and 6010B, Mercury by EPA Methods 74740A and 7471A, Metals by EPA Methods 6020, 6010 and 7470A following EPA Method 1312 Synthetic Precipitation Leaching Procedure (SPLP), Cyanide by EPA Method 9012, pH by EPA Method 9045 and Percent Solids by Modified EPA Method 160.3.

The data were reviewed in accordance with the principles presented in *USEPA National Functional Guidelines for Laboratory Data Review, Organics* (EPA, 2005), *USEPA National Functional Guidelines for Laboratory Data Review, Inorganics* (EPA, 2004), and per the requirements of the QAPP, the laboratory standard operating procedures and the specified methods.

Data for the following samples were reviewed.

CAS Job No.	Client ID
1046886	OU1-SW-MW-401
1046887	OU1-SW-MW-401
1046891	OU1-SW-MW-401
1046894	OU1-SW-MW-401
1046895	OU1-MW-402
1046896	OU1-SW-MW-405
1046899	OU1-SW-MW-401
1046900	OU1-SW-MW-405

1046903	OU1-SS-SB-306-0-1
1046909	OU1-SS-SB-306-0-1
1046910	OU1-SS-SB-306-0-1
1046915	OU1-SS-SB-306-0-1
1046916	OU1-SS-SB-306-67-68
1046917	OU1-SS-SB-306-67-68
1046918	OU1-SS-SB-306-66-67

Matrix – soil, 1 aqueous trip blank, 1 aqueous field blank and 1 aqueous equipment blank

Executive Summary

All analyses were performed as requested on the chain of custody (COC). The dates of sample collection and date sample were relinquished on the COC only included the month and day; the year was not included in the date. It was assumed, based on the date of sample receipt at the laboratory, that the year was 2007.

All holding times were met.

1.0 Volatile Organic Compounds (EPA Method 8260B)

Full validation including recalculation was performed with the laboratory data for the analysis of volatile organic compounds (EPA Method 8260B). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Internal Standards
- ✓ Performance Check Sample
- ⊗ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ⊗ Matrix Spike/Matrix Spike Duplicate Sample
- ✓ Laboratory Control Samples
- ✓ Compound Identification and Quantitation

1.1 Data Completeness

All analyses were performed as requested on the COC.

1.2 Holding Times and Preservation

All samples were analyzed within the 14 day technical holding time from date of collection for volatiles.

1.3 Calibrations

1.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the percent relative standard deviation (%RSD) of the relative response factors (RRFs). For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

1.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

1.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts

1.5 Performance Check Samples

An instrument performance check sample (tune standard) was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for bromofluorobenzene (BFB).

1.6 Blanks

Acetone, carbon disulfide, methylene chloride and toluene were detected in the method blank associated with the soil sample, at estimated concentrations greater than the method detection limit (MDL) but less than the reporting limit (RL). Acetone was detected in the associated sample at a concentration greater than five times the RL; therefore, no sample qualifications were made to the sample acetone concentration. However, based on the estimated concentrations of carbon disulfide, methylene chloride and toluene in the associated sample greater than the MDL but less than the RL, the concentrations of carbon disulfide, methylene chloride and toluene in the sample are U qualified as not detected at the RL.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB-306-0-1	Carbon disulfide	5.8 J	10 U
	Methylene chloride	0.74 J	5.0 U
	Toluene	1.3 JB	5.0 U

Sample OU1-SW-MW-401 is the equipment blank, sample OU1-MW-402 is the trip blank, and OU1-SW-MW-405 is the field blank. The following compounds were

detected in each of these blanks at estimated concentrations less than the RL, but greater than the MDL. No soil sample qualifications were required, based on these detections and the concentrations of the compounds in the associated samples.

OU1-SW-MW-401 (equipment blank) - acetone, carbon disulfide, methylene chloride, styrene

OU1-MW-402 (trip blank) - acetone

OU1-SW-MW-405 (field blank) - acetone, methylene chloride, 4-methyl-2-pentanone, toluene, o-xylene and m,p-xylene.

The method blank associated with the field QC samples listed above had methylene chloride detected at an estimated concentration less than the RL, but greater than the MDL. Methylene chloride was not detected in sample OU1-MW-402 (trip blank); therefore, no sample qualifications were required. However, based on the method blank concentration, the estimated concentrations of methylene chloride in samples OU1-SW-MW-401 and OU1-SW-MW-405 (greater than the MDL but less than the RL) are U qualified as not detected at the RL.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-SW-MW-401	Methylene chloride	0.20 JB	1.0 U
OU1-SW-MW-405	Methylene chloride	0.23 JB	1.0 U

1.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

1.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits.

1.9 Matrix Spike/Matrix Spike Duplicate Sample (MS/MSD)

A MS/MSD pair was not analyzed.

1.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

2.0 Semivolatile Organic Compounds (EPA Method 8270C)

Full validation including recalculation was performed on the laboratory data for the analysis of semivolatile organic compounds (EPA Method 8270C). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation

- ⊗ Calibrations
- ✓ Internal Standards
- ⊗ Performance Check Sample
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ⊗ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

2.1 Data Completeness

All analyses were performed as requested on the COC.

2.2 Holding Times and Preservation

The samples for semivolatile analysis were extracted within the 7 day technical holding time (water) and 14 day technical holding time (soil) from date of collection and analyzed within the 40 day technical holding time from date of extraction.

2.3 Calibrations

2.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the RRFs. For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

2.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria, with the following exceptions. Benzaldehyde in the CCV associated with the soil sample and benzaldehyde and 2,4-dinitrophenol in the CCV associated with the water sample were outside of the acceptance criteria. Therefore, the concentrations of benzaldehyde and 2,4-dinitrophenol in these samples are UJ qualified as estimated less than the RL.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB-306-0-1	Benzaldehyde	430 U	430 UJ

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-SW-MW-401	Benzaldehyde	9.4 U	9.4 UJ
	2,4-dinitrophenol	47 U	47 UJ

2.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts.

2.5 Performance Check Samples

An instrument performance check sample was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for decafluorotriphenylphosphine (DFTPP). It was noted that on all of the 5B forms, the percent relative abundances for mass 441 compared to mass 443 were wrong. Recalculation using the raw data confirmed that mass 441 passed the method criteria; therefore, no sample qualifications were required. The laboratory was notified.

2.6 Blanks

There were no detections of the project compounds of concern in the laboratory method blanks.

Sample OU1-SW-MW-401 is the equipment blank. No compounds were detected in the equipment blank.

2.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

2.8 Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD)

All LCS recoveries were within the laboratory control limits, with the exception of high recoveries outside of the laboratory control limits for benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, chrysene, dibenz(a,h)anthracene and di-n-octylphthalate in the water LCS and/or LCSD. However, since none of these compounds were detected in the associated sample, no sample qualifications were required. All soil LCS/LCSD recoveries and RPDs were acceptable.

2.9 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

A MS/MSD pair was not analyzed.

2.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate

3.0 **Total Metals (EPA Methods 6020/6010B/7470A/7471A)**

The soil and water samples were analyzed for the requested metals and Mercury (EPA 6020/6010B/7470A/7471A) following a total metals digestion and Mercury digestion. Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPS and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of

review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ⊗ Blanks
- ⊗ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ⊗ Laboratory Duplicate Samples
- ⊗ Serial Dilutions
- ⊗ Compound Identification and Quantitation

3.1 Data Completeness

All analyses were performed as requested on the COC.

3.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

3.3 Calibrations

3.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

3.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits, with the following exception. Beryllium recovery was low and outside of the QC acceptance limits in the closing CCV bracketing the analyses of samples OU1-SS-SB306-0-1, OU1-SS-SB306-67-68 and OU1-SS-SB306-66-67; therefore, the concentrations of beryllium in these samples are J-qualified as estimated with a low bias.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB306-0-1	Beryllium	0.915 B	0.915 J-
OU1-SS-SB306-67-68	Beryllium	2.1 B	2.1 J-
OU1-SS-SB306-66-67	Beryllium	1.3 B	1.3 J-

3.3.3 CRDL (Detection Limit) Standard

The CRDL standards were within the control limits.

3.3.4 ICSA/ICSAB (Interference Check) Standards

The ICSA/ICSAB standards met all acceptance criteria.

3.4 Blanks

3.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria with the following exceptions; chromium, copper and manganese were detected in the water preparation blank at estimated concentrations less than the RL, but greater than the instrument detection limits (IDL). Barium, calcium, chromium, lead, sodium and zinc were detected in the soil preparation blank at estimated concentrations less than the RL, but greater than the IDL. However, since the compounds detected in the blanks were either detected in the associated samples at concentrations greater than the RL or not detected, no sample qualifications were required.

3.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria with a few exceptions; several ICBs and CCBs had metal detections at estimated concentrations less than the RL, but greater than the IDLs. However, since the metals concentrations in the associated samples were greater than the RL, no sample qualifications were required.

3.4.3 Field QC Samples

Sample OU1-SW-MW-401 is the equipment blank and OU1-SW-MW-405 is the field blank. The following compounds were detected in each of these blanks at estimated concentrations less than the RL, but greater than the IDL. No soil sample qualifications were required, based on these detections and the concentrations of the metals in the associated samples, since the concentrations in the associated samples were greater than the RL.

OU1-SW-MW-401 (equipment blank) – barium, calcium, chromium, copper, lead, manganese, nickel, sodium, vanadium and zinc.

OU1-SW-MW-405 (field blank) - chromium, copper, lead, nickel and vanadium.

3.5 Laboratory Control Samples (LCS)

All percent recoveries in the LCS were within the acceptance limits.

3.6 Matrix Spike (MS)

An MS was not analyzed.

3.7 Laboratory Duplicate Samples

A laboratory duplicate was not analyzed.

3.8 Serial Dilutions

The percent differences for the compounds for the serial dilution for the total metals analysis of sample OU1-SW-MW-405 were outside of the laboratory acceptance criteria for copper, lead, nickel and zinc; however, the copper, lead, nickel and zinc concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required.

The percent differences for the compounds for the serial dilution for the total metals analysis of sample OU1-SS-SB306-67-68 were outside of the laboratory acceptance criteria for aluminum, beryllium, antimony, arsenic, calcium, chromium, lead and magnesium; however, the beryllium, antimony, arsenic calcium, chromium, lead and magnesium in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required. The concentrations of aluminum and calcium are J qualified as estimated, since the sample concentrations are greater than 50 times the IDL.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB306-67-68	Aluminum	13900 E	13900 J
	Calcium	127000 E	127000 J

3.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

The concentrations of some compounds in the samples were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the IDL. These concentrations are J qualified as estimated.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-SW-MW-401	Calcium	173 B	173 J
	Chromium	2.1 B	2.1 J
	Copper	0.618 B	0.618 J
	Manganese	9.2 B	9.2 J
	Nickel	0.264 B	0.264 J
	Sodium	75.1 B	75.1 J
	Vanadium	0.784 B	0.784 J
	Zinc	6.3 B	6.3 J
OU1-SW-MW-405	Chromium	1.3 B	1.3 J
	Copper	0.600 B	0.600 J
	Lead	0.130 B	0.130 J
	Nickel	0.109 B	0.109 J
	Vanadium	0.280 B	0.280 J

Sample	Metal	Laboratory Concentration (mg/kg)	Validation Concentration (mg/kg)
OU1-SS-SB306-0-1	Antimony	4.2 B	4.2 J
	Beryllium	0.915 B	0.915 J
	Selenium	0.874 B	0.874 J
	Silver	1.3 B	1.3 J
	Sodium	126 B	126 J
	Thallium	0.395 B	0.395 J

OU1-SS-SB306-67-68	Antimony	4.8 B	4.8 J
	Beryllium	2.1 B	2.1 J
	Mercury	0.005 B	0.005 J
	Sodium	457 B	457 J
	Thallium	0.159 B	0.159 J
OU1-SS-SB306-66-67	Antimony	5.1 B	5.1 J
	Arsenic	0.192 B	0.192 J
	Chromium	1.8 B	1.8 J

4.0 SPLP Metals (EPA Methods 1312/6020/6010B/7470A)

The soil samples were analyzed for the requested metals and Mercury (EPA 6020/6010B/7470A) following a Synthetic Precipitation Leaching Procedure (SPLP). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ⊗ Blanks
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ✓ Laboratory Duplicate Samples
- ✓ Serial Dilutions
- ⊗ Compound Identification and Quantitation

4.1 Data Completeness

All analyses were performed as requested on the COC. The SPLP extraction log was requested from the laboratory and was sent by email.

4.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

4.3 Calibrations

4.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

4.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits.

4.3.3 CRDL Standard

The CRDL standards were within the control limits.

4.3.4 ICSA/ICSAB Standards

The ICSA/ICSAB met all acceptance criteria.

4.4 Blanks

4.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria with the following exceptions; arsenic, chromium, lead and zinc were detected in the preparation blank at estimated concentrations less than the RL, but greater than the IDL. Therefore, based on the samples' arsenic, chromium, iron, lead and zinc concentrations which were less than the RL, but greater than the IDL, the concentrations are U qualified as not detected at the RL.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-SS-SB-306-67-68	Chromium	1.2 B	3.0 U
	Lead	0.297 B	1.0 U
OU1-SW-MW-401	Chromium	1.7 B	1.0 U
	Zinc	10.4 B	20 U

4.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria with a few exceptions; several ICBs and CCBs had metal detections at estimated concentrations less than the RL, but greater than the IDL. However, since the metals concentrations in the associated samples were greater than the RL, no sample qualifications were required.

4.5 Laboratory Control Samples (LCS)

All percent recoveries in the LCS were within the acceptance limits.

4.6 Matrix Spike (MS)

A MS was not analyzed..

4.7 Laboratory Duplicate Samples

A sample duplicate was not analyzed.

4.8 Serial Dilutions

The percent differences for the compounds for the serial dilution for the SPLP analysis of sample OU1-SS-SB-306-67-68 were outside of the laboratory acceptance criteria for copper, nickel, lead, thallium and vanadium; however, since the concentrations of copper, lead, thallium and vanadium are less than 50 times the IDL,

no sample qualifications are required. The concentration of nickel in sample OU1-SS-SB-306-67-68 is J qualified since it is greater than 50 times the IDL.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-SS-SB-306-67-68	Nickel	61.4	61.4 J

4.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

The concentrations of some compounds in the samples were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the instrument detection limit. These concentrations are J qualified as estimated.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-SS-SB-306-67-68	Chromium	1.2 B	1.2 J
	Iron	50.6 B	50.6 J
	Lead	0.297 B	0.297 J
	Thallium	0.066 B	0.066 J
	Vanadium	0.481 B	0.481 J
OU1-SW-MW-401	Calcium	176 B	176 J
	Chromium	1.7 B	1.7 J
	Copper	0.619 B	0.619 J
	Iron	33.9 B	33.9 J
	Magnesium	9.4 B	9.4 J
	Nickel	0.314 B	0.314 J
	Sodium	204 B	204 J
	Vanadium	0.393 B	0.393 J
	Zinc	10.4 B	10.4 J

5.0 Cyanide (EPA Method 9012) and Percent Solids (Modified Method 160.3)

The samples were analyzed for cyanide (EPA Method 9012) and percent solids (EPA Modified Method 160.3). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review. In addition, the percent solids data was reviewed and found to be acceptable.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ Laboratory Control Sample
- ✓ Matrix Spike Sample
- ✓ Laboratory Duplicate Sample

5.1 Data Completeness

All analyses were performed as requested on the COC.

5.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

5.3 Calibrations

5.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for Cyanide analysis.

5.3.2 Continuing Calibration Verification (CCV)

The percent recoveries in all associated CCVs were within the QC acceptance limits for Cyanide.

5.4 Blanks

5.4.1 Preparation (Method) Blank

The preparation blank met the acceptance criteria; Cyanide was not detected in the method blank.

5.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICB and CCBs met the acceptance criteria; no Cyanide was detected in either the ICB or CCBs.

5.5 Laboratory Control Sample (LCS)

The cyanide percent recovery in the LCS was within the acceptance limits (85-115% recovery).

5.6 Matrix Spike (MS)

A MS was not analyzed.

5.7 Laboratory Duplicate Samples

A laboratory duplicate was not analyzed.

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ATTACHMENT A
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by GeoSyntec's Data Review Team

DATA QUALIFIER DEFINITIONS

- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Memorandum

TO: Nandra Weeks

DATE: March 6, 2008

FROM: Geosyntec Consultants QA/QC Group

SITE: Mattheissen and Hegeler Zinc Company Site, OU1

SUBJECT: Summary of Tier III Validation of analytical results for CAS Report R2740363

Introduction

This report summarizes the findings of the full validation of ten soil samples, two equipment blanks and three field blanks collected on behalf of the Mattheissen and Hegeler Zinc Company Site, OU1 project. These samples were collected on October 17-18, 2007. The samples were analyzed by Columbia Analytical Services, Inc. (CAS), Rochester, New York. The samples were analyzed for Volatile Organic Compounds by EPA Method 8260B, Semivolatile Organic Compounds by EPA Method 8270C, Organochlorine Pesticides by EPA Method 8081A, Polychlorinated Biphenyls (PCBs) by EPA Method 8082, Total Metals by EPA Methods 6020 and 6010B, Mercury by EPA Methods 7470A and 7471A, Metals by EPA Methods 6020, 6010 and 7470A following EPA Method 1312 Synthetic Precipitation Leaching Procedure (SPLP), Cyanide by EPA Method 9012, pH by EPA Method 9045 and Percent Solids by Modified EPA Method 160.3.

The data were reviewed in accordance with the principles presented in *USEPA National Functional Guidelines for Laboratory Data Review, Organics* (EPA, 2005), *USEPA National Functional Guidelines for Laboratory Data Review, Inorganics* (EPA, 2004), and per the requirements of the QAPP, the laboratory standard operating procedures and the specified methods.

Data for the following samples were reviewed.

CAS Job No.	Client ID
1047225	OU1-SS-SB308-26.5-27.5
1047226	OU1-SS-SB308-26.5-27.5
1047227	OU1-SS-SB308-36.5-37.5
1047228	OU1-SS-SB308-0-1
1047229	OU1-SS-SB309-0-1 MS/MSD

1047230	OU1-SS-SB309-48-49
1047231	OU1-SS-SB305-0-1
1047234	OU1-SS-SB309-28.25-29.25
1047236	OU1-SS-SB309-18.25-19.25
1047239	OU1-SS-SB406-0-1
1047242	OU1-SS-SB305-90-91
1047243	OU1-SS-SB305-89-90
1047244	OU1-SS-SB308-36.5-37.5
1047245	OU1-SS-SB309-48-49 MS/MSD
1047246	OU1-SS-SB406-0-1
1047250	OU1-SS-SB308-36.5-37.5
1047251	OU1-SS-SB309-48-49 MS/MSD
1047252	OU1-SS-SB406-0-1
1047253	OU1-SS-SB308-36.5-37.5
1047254	OU1-SS-SB309-48-49 MS/MSD
1047255	OU1-SS-SB406-0-1
1047261	OU1-SS-SB309-28.5-29.5 MS/MSD
1047267	OU1-SS-SB309-0-1MS/MSD
1047269	OU1-SS-SB305-0-1
1047271	OU1-SS-SB406-0-1
1047277	OU1-SW-MW401-B
1047279	OU1-SW-MW401-B
1047280	OU1-SW-MW401-B
1047281	OU1-SW-MW401
1047282	OU1-SW-MW401-B
1047283	OU1-SW-MW405
1047284	OU1-SW-MW401-B
1047285	OU1-SW-MW401
1047286	OU1-SW-MW405-B
1047287	OU1-SW-MW405
1047288	OU1-SW-MW401-B
1047289	OU1-SW-MW401
1047290	OU1-SW-MW405A
1047291	OU1-SW-MW401A
1047292	OU1-SS-SB406-0-1
1047293	OU1-SW-MW405-B
1047294	OU1-SW-MW405
1047295	OU1-SW-MW401
1047296	OU1-SW-MW401
1047297	OU1-SW-MW401
1047298	OU1-SS-SB305-90-91

Matrix – soil, 2 aqueous equipment blanks and 3 field blanks

Executive Summary

All analyses were performed as requested on the chain of custody (COC). The dates of sample collection and date sample were relinquished on the COC only included the month and day; the

year was not included in the date. It was assumed, based on the date of sample receipt at the laboratory, that the year was 2007.

All holding times were met.

1.0 Volatile Organic Compounds (EPA Method 8260B)

Full validation including recalculation was performed with the laboratory data for the analysis of volatile organic compounds (EPA Method 8260B). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Internal Standards
- ✓ Performance Check Sample
- ⊗ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ⊗ Matrix Spike/Matrix Spike Duplicate Sample
- ✓ Laboratory Control Samples
- ✓ Compound Identification and Quantitation

1.1 Data Completeness

All analyses were performed as requested on the COC.

1.2 Holding Times and Preservation

All samples were analyzed within the 14 day technical holding time from date of collection for volatiles.

1.3 Calibrations

1.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the percent relative standard deviation (%RSD) of the relative response factors (RRFs). For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

1.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria,

with the following exceptions. Bromomethane and 1,1,2-trichloro-1,2,2,-trifluoroethane were outside of the acceptance limits in the CCV associated with the analyses of the field QC samples (all aqueous samples). Therefore, the undetected concentrations of bromomethane and 1,1,2-trichloro-1,2,2,-trifluoroethane in the field QC samples are UJ qualified as not detected less than the reporting limits (RL).

Sample ID	Date Collected	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-SW-MW405	10/17/07	Bromomethane	2.0 U	2.0 UJ
		1,1,2-trichloro-1,2,2,-trifluoroethane	1.0 U	1.0 UJ
OU1-SW-MW401-B	10/17/07	Bromomethane	2.0 U	2.0 UJ
		1,1,2-trichloro-1,2,2,-trifluoroethane	1.0 U	1.0 UJ
OU1-SW-401	10/17/07	Bromomethane	2.0 U	2.0 UJ
		1,1,2-trichloro-1,2,2,-trifluoroethane	1.0 U	1.0 UJ
OU1-SW-405-B	10/17/07	Bromomethane	2.0 U	2.0 UJ
		1,1,2-trichloro-1,2,2,-trifluoroethane	1.0 U	1.0 UJ
OU1-SW-405	10/18/07	Bromomethane	2.0 U	2.0 UJ
		1,1,2-trichloro-1,2,2,-trifluoroethane	1.0 U	1.0 UJ

1.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts

1.5 Performance Check Samples

An instrument performance check sample (tune standard) was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for bromofluorobenzene (BFB).

1.6 Blanks

Acetone and methylene chloride were detected in the method blank associated with the soil samples analyzed on 10/26/07 and acetone was detected in the method blank

associated with the soil samples analyzed on 10/29/07, at estimated concentrations greater than the method detection limit (MDL) but less than the RL. Therefore, based on the concentration of acetone in the method blank and in sample OU1-SS-SB309-48-49, the concentration of acetone is U qualified as not detected at an elevated RL. The estimated concentrations of methylene chloride in samples OU1-SS-SB309-48-49 and OU1-SS-SB406-0-1 greater than the MDL but less than the RL are U qualified as not detected at the RL.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB309-48-49	Acetone	28 B	28 U
	Methylene chloride	0.53 JB	5.0 U
OU1-SS-SB406-0-1	Methylene chloride	0.64 JB	5.0 U

Samples OU1-SW-MW-401-B (collected 10/17/07) and OU1-SW-MW-401 (collected 10/17/07) are equipment blanks and samples OU1-SW-MW-405 (collected 10/17/07), OU1-SW-MW-405-B (collected 10/17/07) and OU1-SW-MW-405 (collected 10/18/07) are field blanks. A trip blank was not sent with the samples. The following compounds were detected in each of these blanks at estimated concentrations less than the RL, but greater than the MDL. No soil sample qualifications were required, based on these detections and the concentrations of the compounds in the associated samples.

OU1-SW-MW-401-B (collected 10/17/07, equipment blank) – acetone and styrene
 OU1-SW-MW-401 (collected 10/17/07, equipment blank) – acetone and styrene
 OU1-SW-MW-405 (collected 10/17/07, field blank) – acetone
 OU1-SW-MW-405-B (collected 10/17/07, field blank) – acetone, bromodichloromethane and chloroform
 OU1-SW-MW-405 (collected 10/18/07, field blank) – bromodichloromethane and chloroform

1.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

1.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits, with the exception of high dichlorodifluoromethane recovery outside of the laboratory control limits in the LCS associated with the analysis of sample OU1-SS-SB308-36.5-37.5. Since dichlorodifluoromethane was not detected in sample OU1-SS-SB308-36.5-37.5, no sample qualification was required.

1.9 Matrix Spike/Matrix Spike Duplicate Sample (MS/MSD)

Sample OU1-SS-SB309-48-49 was analyzed as the MS/MSD. All compound recoveries were within the laboratory control limits, with the following exceptions. 1,4-Dichlorobenzene, styrene, 1,2,4-trichlorobenzene and vinyl chloride had low recoveries outside of the laboratory control limits in the MS and/or the MSD; therefore, the undetected concentrations of 1,4-dichlorobenzene, styrene, 1,2,4-

trichlorobenzene and vinyl chloride in sample OU1-SS-SB309-48-49 are UJ qualified as estimated less than the RL.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB309-48-49	1,4-Dichlorobenzene	6.7 U	6.7 UJ
	Styrene	6.7 U	6.7 UJ
	1,2,4-Trichlorobenzene	6.7 U	6.7 UJ
	Vinyl chloride	6.7 U	6.7 UJ

1.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

2.0 Semivolatile Organic Compounds (EPA Method 8270C)

Full validation including recalculation was performed on the laboratory data for the analysis of semivolatile organic compounds (EPA Method 8270C). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Internal Standards
- ⊗ Performance Check Sample
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ✓ Matrix Spike/Matrix Spike Duplicate
- ⊗ Compound Identification and Quantitation

2.1 Data Completeness

All analyses were performed as requested on the COC.

2.2 Holding Times and Preservation

The samples for semivolatile analysis were extracted within the 7 day technical holding time (water) and 14 day technical holding time (soil) from date of collection and analyzed within the 40 day technical holding time from date of extraction.

2.3 Calibrations

2.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the RRFs. For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

2.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

2.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts.

2.5 Performance Check Samples

An instrument performance check sample was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for decafluorotriphenylphosphine (DFTPP). It was noted that on all 5B forms, the percent relative abundances for mass 441 compared to mass 443 were wrong. However, the raw data confirmed that mass 441 passed the method criteria; therefore, no sample qualifications were required. The laboratory was notified of this error.

2.6 Blanks

There were no detections of the project compounds of concern in the laboratory method blanks.

Sample OU1-SW-MW401-B was the equipment blank. No compounds were detected in the equipment blank.

2.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

2.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits.

2.9 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Sample OU1-SS-SB309-48-49 was analyzed as the MS/MSD. All compound recoveries were within the laboratory control limits.

2.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate, with the following exception. The concentration of benzo(a)pyrene in sample OU1-SS-SB308-36.5-37.5 was reported incorrectly. The correct estimated concentration of benzo(a)pyrene in

sample OU1-SS-SB308-36.5-37.5, corrected for the percent solids in the sample, is noted in the table below.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB308-36.5-37.5	Benzo(a)pyrene	110 J	120 J

3.0 Organochlorine Pesticides (EPA Method 8081A)

Full validation including recalculation was performed on the laboratory data for the analysis of Organochlorine Pesticides (EPA Method 8081A). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ✓ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

3.1 Data Completeness

All analyses were performed as requested on the COC.

3.2 Holding Times and Preservation

The samples for organochlorine pesticide analysis were extracted within the 7 day technical holding time (water) and 14 day technical holding time (soil) time from date of collection and analyzed within the 40 day technical holding time from date of extraction.

3.3 Calibrations

3.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the average response factors (RFs). For all target analytes, the RSDs met the method criteria for all compounds.

3.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the percent differences (%D) between the average RFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

3.4 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

Samples OU1-SW-MW401 and OU1-SW-MW401-B were the equipment blanks. No compounds were detected in the equipment blanks.

3.5 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

3.6 Laboratory Control Samples (LCS)

All LCS/LCS duplicate (LCSD) recoveries and RPDs were within the laboratory control limits.

3.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Sample OU1-SS-SB309-0-1 was analyzed as the MS/MSD. All compound recoveries were within the laboratory control limits.

3.8 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate. It was noted that J qualified concentrations (sample concentrations between the MDL and RL) were not reported by the laboratory.

4.0 PCBs (EPA Method 8082)

Full validation including recalculation was performed on the laboratory data for the analysis of PCBs (EPA Method 8082). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ✓ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

4.1 Data Completeness

All analyses were performed as requested on the COC.

4.2 Holding Times and Preservation

The samples for PCB analysis were extracted within the 14 day technical holding time from date of collection and analyzed within the 40 day technical holding time from date of extraction.

4.3 Calibrations

4.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the average response factors (RFs). For all target analytes, the RSDs met the method criteria for all compounds.

4.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the percent differences (%D) between the average RFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

4.4 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

4.5 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

4.6 Laboratory Control Samples (LCS)

All LCS/LCS duplicate (LCSD) recoveries and RPDs were within the laboratory control limits.

4.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Sample OU1-SS-SB309-0-1 was analyzed as the MS/MSD. All compound recoveries were within the laboratory control limits.

4.8 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

5.0 Metals (EPA Methods 6020/6010B/7470A/7471A)

The soil and water samples were analyzed for the requested metals and Mercury (EPA 6020/6010B/7470A/7471A) following total metals digestion and Mercury digestion. Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPS and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of

review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ⊗ Blanks
- ⊗ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ⊗ Laboratory Duplicate Samples
- ⊗ Serial Dilutions
- ⊗ Compound Identification and Quantitation

5.1 Data Completeness

All analyses were performed as requested on the COC.

The laboratory used the client sample ID OU1-SW-MW405 for field blank OU1-SW-MW405, collected 10/17/07 and client sample ID OU1-SW-MW405A for field blank OU1-SW-MW405, collected 10/18/07. The COC lists the same client sample ID (OU1-SW-MW405) for both of the field blank samples collected on 10/17/07 and 10/18/07.

The laboratory used the client sample ID OU1-SW-MW401 for equipment blank OU1-SW-MW401, collected 10/17/07 and client sample ID OU1-SW-MW401A for equipment blank OU1-SW-MW401, collected 10/18/07. The COC lists the same client sample ID (OU1-SW-MW401) for both of the equipment blank samples collected on 10/17/07 and 10/18/07.

5.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

5.3 Calibrations

5.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

5.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits (for waters), with the following exception. Aluminum was slightly high (111%, limits 90-110%) and outside of the QC acceptance limits in the closing CCV for the soil analyses; however, based on professional judgment, no sample qualifications were made.

5.3.3 CRDL (Detection Limit) Standard

The CRDL standards were within the control limits, with the following exception. Selenium recovery was low and outside of the acceptance limits in the closing CRDL for the soil analyses. Based on professional judgment and due to the sample concentration, the estimated concentration of selenium in sample OU1-SS-SB-305-90-91 was J- qualified as estimated with a low bias. All other sample concentrations were above the RL.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB-305-90-91	Selenium	0.668 B	0.668 J-

5.3.4 ICSA/ICSAB (Interference Check) Standards

The ICSA/ICSAB standards met all acceptance criteria.

5.4 Blanks

5.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria with the following exceptions; chromium, copper, lead and manganese were detected in the water preparation blank at estimated concentrations less than the RL, but greater than the instrument detection limits (IDL). Therefore, the concentrations of chromium, copper, lead and manganese detected in the associated samples at concentrations less than the RL, but greater than the IDL are U qualified as not detected at the RL.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-SW-MW405-B	Chromium	1.2 B	3.0 U
	Copper	0.577 B	1.0 U
	Lead	0.068 B	1.0 U
OU1-SW-MW405	Chromium	1.0 B	3.0 U
	Copper	0.547 B	1.0 U
	Lead	0.051 B	1.0 U
OU1-SW-MW401-B	Chromium	1.1 B	3.0 U
	Copper	0.103 B	1.0 U
	Lead	0.127 B	1.0 U
	Manganese	0.973 B	10 U
OU1-SW-MW401	Chromium	1.1 B	3.0 U
	Copper	0.191 B	1.0 U
	Lead	0.483 B	1.0 U
	Manganese	5.6 B	10 U
OU1-SW-MW405A	Chromium	0.929 B	3.0 U
	Copper	0.249 B	1.0 U
	Lead	0.049 B	1.0 U
OU1-SW-MW401A	Chromium	0.296 B	3.0 U
	Copper	0.189 B	1.0 U
	Lead	0.483 B	1.0 U

Antimony, chromium and lead were detected in the soil preparation blank at estimated concentrations less than the RL, but greater than the IDL. Therefore, the concentrations of antimony detected in the associated samples at concentrations less than the RL but greater than the IDL were U qualified as not detected at the RL. Based on professional judgment, no qualifications were made if the antimony concentration was greater than 10 times the blank concentration. Additionally, no qualifications were required for the chromium and lead, as all sample concentrations were greater than the RL.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB305-90-91	Antimony	3.8 B	6.0 U
OU1-SS-SB305-89-90	Antimony	3.2 B	6.0 U

5.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria with a few exceptions; several ICBs and CCBs had metal detections at estimated concentrations less than the RL, but greater than the IDLs. However, based on professional judgment and since the metals concentrations in the associated samples were either greater than the RL or not detected, no additional sample qualifications were made.

5.4.3 Field QC Samples

Samples OU1-SW-MW-401, OU1-SW-MW-401A and OU1-SW-MW-401-B are equipment blanks and OU1-SW-MW-405, OU1-SW-MW-405-B and OU1-SW-MW-405A are field blanks. The following compounds were detected in each of these blanks at estimated concentrations less than the RL, but greater than the IDL. No soil sample qualifications were required, based on these detections and the concentrations of the metals in the associated samples.

OU1-SW-MW-405-B (field blank, collected 10/17/07) – barium, chromium, copper, lead, nickel, potassium, vanadium and zinc.

OU1-SW-MW-405 (field blank, collected 10/17/07) - chromium, copper, lead, nickel and vanadium.

OU1-SW-MW-405A (field blank, collected 10/18/07) - barium, chromium, copper, lead and vanadium.

OU1-SW-MW-401-B (equipment blank, collected 10/17/07) – barium, chromium, copper, lead, manganese, nickel, sodium and zinc.

OU1-SW-MW-401 (equipment blank, collected 10/17/07) - barium, chromium, copper, lead, manganese, nickel and vanadium.

OU1-SW-MW-401A (equipment blank, collected 10/18/07) – aluminum, barium, calcium, chromium, copper, lead, nickel, sodium and vanadium.

The following compounds were detected in each of these blanks at concentrations greater than the RL:

OU1-SW-MW-405-B (field blank, collected 10/17/07) – sodium

OU1-SW-MW-405A (field blank, collected 10/18/07) – sodium

OU1-SW-MW-401A (equipment blank, collected 10/18/07) – manganese, zinc

Based on professional judgment, no sample qualifications were made to the manganese and zinc sample concentrations, since the manganese and zinc sample concentrations were at least ten times the equipment blank concentrations. However, based on the sodium concentrations in field blanks OU1-SW-MW-405-B of 17000 ug/L (equivalent to 1700 mg/kg) and OU1-SW-MW-405A of 11900 ug/L (equivalent to 1190 mg/kg), the following associated sample concentrations for sodium are R qualified as rejected since they are less than the field blank concentrations.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB308-26.5-27.5	Sodium	326	326 R
OU1-SS-SB308-36.5-37.5	Sodium	514 B	514 R
OU1-SS-SB308-0-1	Sodium	564	564 R
OU1-SS-SB309-0-1	Sodium	520	520 R
OU1-SS-SB309-48-49	Sodium	228	228 R
OU1-SS-SB305-0-1	Sodium	1260	1260 R
OU1-SS-SB309-28.25-29.25	Sodium	391	391 R
OU1-SS-SB309-18.25-19.25	Sodium	614	614 R
OU1-SS-SB406-0-1	Sodium	791	791 R
OU1-SS-SB305-90-91	Sodium	614	614 R
OU1-SS-SB305-89-90	Sodium	696	696 R

5.5 Laboratory Control Samples (LCS)

All percent recoveries in the water LCS were within the acceptance limits.

All percent recoveries in the soil LCS were within the acceptance limits, with the following exceptions. Aluminum, antimony, iron, and magnesium had high recoveries, outside of the laboratory control limits in the LCS. Therefore, the concentrations of aluminum, antimony, iron, and magnesium in the associated samples are J+ qualified as estimated with a high bias.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB308-26.5-27.5	Aluminum	5400	5400 J+
	Antimony	16.0	16.0 J+
	Iron	64800	64800 J+
	Magnesium	1890	1890 J+
OU1-SS-SB308-36.5-37.5	Aluminum	9800	9800 J+
	Antimony	35.6	35.6 J+
	Iron	34100	34100 J+
	Magnesium	16100	16100 J+
OU1-SS-SB308-0-1	Aluminum	11900	11900 J+
	Antimony	13.3	13.3 J+
	Iron	49500	49500 J+
	Magnesium	3680	3680 J+
OU1-SS-SB309-0-1	Aluminum	9460	9460 J+
	Antimony	9.8	9.8 J+
	Iron	29100	29100 J+
	Magnesium	627	627 J+
OU1-SS-SB309-48-49	Aluminum	4340	4340 J+

	Antimony	5.9 B	5.9 J+
	Iron	34700	34700 J+
	Magnesium	17600	17600 J+
OU1-SS-SB305-0-1	Aluminum	13200	13200 J+
	Antimony	6.0 B	6.0 J+
	Iron	35300	35300 J+
	Magnesium	3590	3590 J+
OU1-SS-SB309-28.25-29.25	Aluminum	8110	8110 J+
	Antimony	81.4	81.4 J+
	Iron	123000	123000 J+
	Magnesium	2540	2540 J+
OU1-SS-SB309-18.25-19.25	Aluminum	17200	17200 J+
	Antimony	17.5	17.5 J+
	Iron	33800	33800 J+
	Magnesium	871	871 J+
OU1-SS-SB406-0-1	Aluminum	19400	19400 J+
	Antimony	11.0	11.0 J+
	Iron	34700	34700 J+
	Magnesium	1920	1920 J+
OU1-SS-SB305-90-91	Aluminum	16700	16700 J+
	Antimony	3.8 B	3.8 J+
	Iron	35700	35700 J+
	Magnesium	5870	5870 J+
OU1-SS-SB305-89-90	Aluminum	13600	13600 J+
	Antimony	3.2 B	3.2 J+
	Iron	32400	32400 J+
	Magnesium	2090	2090 J+

5.6 Matrix Spike (MS)

Sample OU1-SW-MW405-B was analyzed as the water MS. Only the metals analyzed by EPA Method 6010B were spiked; all compound recoveries were within the laboratory control limits.

The metals analyzed by EPA Method 6020 for waters were spiked into a batch QC sample. No information was provided on the batch QC sample results.

Sample OU1-SS-SB309-0-1 was analyzed as the soil MS. The following compounds were outside of the laboratory control limits. However, since the concentration of these metals in the unspiked sample exceeded the spike concentration by a factor of four or greater, the spike recovery control limits do not apply and qualification of the data is not required: aluminum, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, manganese, nickel, vanadium and zinc. The recoveries for beryllium and selenium were low and outside of the laboratory control limits and the recovery of magnesium was high and outside of the laboratory control limits. The post digestion spike for beryllium, magnesium and selenium were acceptable.

Therefore, the concentrations of beryllium, magnesium and selenium in sample OU1-SS-SB309-0-1 are J qualified as estimated.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB309-0-1	Beryllium	2.3	2.3 J
	Magnesium	627	627 J
	Selenium	2.0	2.0 J

5.7 Laboratory Duplicate Samples

Sample OU1-SW-MW405-B was analyzed as the water laboratory duplicate. Only the metals analyzed by EPA Method 6010B were assessed in the laboratory duplicate. All RPD results were acceptable, with the exception of potassium and zinc. However, since potassium and zinc were either not detected or detected at a estimated concentration less than the RL, but greater than the IDL, no sample qualifications were required.

The metals analyzed by EPA Method 6020 for waters were assessed using a batch QC sample. No information was provided on the batch QC sample results.

Sample OU1-SS-SB309-0-1 was analyzed as the soil laboratory duplicate. The following metals were outside of the laboratory acceptance limits for RPD: aluminum, antimony, arsenic, beryllium, cadmium, calcium, chromium, cobalt, copper, magnesium, manganese, potassium, selenium, silver, sodium, thallium, vanadium, and zinc. Therefore, the concentrations of aluminum, antimony, arsenic, beryllium, cadmium, calcium, chromium, cobalt, copper, magnesium, manganese, potassium, selenium, sodium, thallium, vanadium and zinc are J qualified as estimated; the concentration of silver is UJ qualified as estimated less than the RL.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB309-0-1	Aluminum	9460	9460 J
	Antimony	9.8	9.8 J
	Arsenic	53.6	53.6 J
	Beryllium	2.3	2.3 J
	Cadmium	68.3	68.3 J
	Calcium	13700	13700 J
	Chromium	17.5	17.5 J
	Cobalt	14.4	14.4 J
	Copper	1460	1460 J
	Magnesium	627	627 J
	Manganese	1510	1510 J
	Potassium	727	727 J
	Selenium	2.0	2.0 J
	Silver	0.360 U	0.360 UJ
	Sodium	520	520 J

	Thallium	0.294 B	0.294 J
	Vanadium	35.0	35.0 J
	Zinc	8310	8310 J

5.8 Serial Dilutions

The percent differences for the serial dilution for the total metals water analysis of sample OU1-SW-MW405-B were outside of the laboratory acceptance criteria for manganese, potassium and zinc; however, the manganese, potassium and zinc concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required. The serial dilution was only performed for the metals analyzed by EPA Method 6010B. The serial dilution for the metals analyzed by EPA Method 6020 for waters was assessed using a batch QC sample. No information was provided on the batch QC sample results.

The percent differences for the serial dilution for the total metals soil analysis of sample OU1-SS-SB309-0-1 were outside of the laboratory acceptance criteria for arsenic, beryllium, chromium, cobalt, nickel, potassium, selenium, sodium and vanadium; however, the beryllium, chromium, cobalt and selenium concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required for those metals. The concentrations of arsenic, nickel, potassium, sodium and vanadium in sample OU1-SS-SB309-0-1 are J qualified as estimated since the sample concentrations are greater than 50 times the IDL.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB309-0-1	Arsenic	53.6	53.6 J
	Nickel	27.8	27.8 J
	Potassium	727	727 J
	Sodium	520	520 J
	Vanadium	35.0	35.0 J

5.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

The concentrations of some compounds in the samples were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the IDL. These concentrations are J qualified as estimated.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-SW-MW405-B	Nickel	0.208 B	0.208 J
	Potassium	181 B	181 J
	Vanadium	0.440 B	0.440 J
	Zinc	3.8 B	3.8 J

OU1-SW-MW405	Nickel	0.113 B	0.113 J
	Vanadium	0.204 B	0.204 J
OU1-SW-MW401-B	Barium	0.229 B	0.229 J
	Nickel	0.101 B	0.101 J
	Vanadium	0.477 B	0.477 J
OU1-SW-MW401	Barium	0.651 B	0.651 J
	Nickel	0.135 B	0.135 J
	Sodium	69.6 B	69.6 J
	Zinc	7.2 B	7.2 J
OU1-SW-MW405 A	Barium	0.147 B	0.147 J
	Vanadium	0.406 B	0.406 J
OU1-SW-MW401A	Aluminum	63.8 B	63.8 J
	Barium	0.788 B	0.788 J
	Calcium	317 B	317 J
	Nickel	0.090 B	0.090 J
	Sodium	90.9 B	90.9 J
	Vanadium	0.202 B	0.202 J

Sample	Metal	Laboratory Concentration (mg/kg)	Validation Concentration (mg/kg)
OU1-SS-SB308-26.5-27.5	Beryllium	1.1 B	1.1 J
	Thallium	0.343 B	0.343 J
OU1-SS-SB308-36.5-37.5	Antimony	35.6 B	35.6 J
	Potassium	828 B	828 J
	Sodium	514 B	514 J
OU1-SS-SB309-0-1	Thallium	0.294 B	0.294 J
OU1-SS-SB309-48-49	Antimony	5.9 B	5.9 J
	Beryllium	0.358 B	0.358 J
	Mercury	0.020 B	0.020 J
	Thallium	0.181 B	0.181 J
OU1-SS-SB305-0-1	Antimony	6.0 B	6.0 J
	Beryllium	1.2 B	1.2 J
OU1-SS-SB309-28.25-29.25	Thallium	0.293 B	0.293 J
OU1-SS-SB309-18.25-19.25	Silver	0.659 B	0.659 J
	Thallium	0.565 B	0.565 J
OU1-SS-SB406-0-1	Thallium	0.265 B	0.265 J
OU1-SS-SB305-90-91	Antimony	3.8 B	3.8 J
	Beryllium	1.1 B	1.1 J
	Selenium	0.668 B	0.668 J
	Thallium	0.264 B	0.264 J
OU1-SS-SB305-89-90	Antimony	3.2 B	3.2 J
	Beryllium	0.780 B	0.780 J

	Thallium	0.214 B	0.214 J
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6.0 SPLP Metals (EPA Methods 1312/6020/6010B/7470A)

The soil samples were analyzed for the requested metals and Mercury (EPA 6020/6010B/7470A) following a Synthetic Precipitation Leaching Procedure (EPA Method 1213, SPLP). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ⊗ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ⊗ Blanks
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ✓ Laboratory Duplicate Samples
- ✓ Serial Dilutions
- ⊗ Compound Identification and Quantitation

6.1 Data Completeness

All analyses were performed as requested on the COC, with the following exceptions. Samples OU1-SW-MW401 (collected 10/17/07), OU1-SW-MW401-B (collected 10/17/07) and OU1-SW-MW401 (collected 10/18/07) were listed on the COC for SPLP analyses, but were not reported. Additionally, sample OU1-SS-SB309-48-49 was analyzed, but not listed on the COC for SPLP analysis.

The SPLP extraction log was requested from the laboratory and was sent by email.

6.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

6.3 Calibrations

6.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

6.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits, with the following exception. One CCV had copper recovery

slightly high and outside of the method acceptance limits (112%, limits 90-110%). However, based on professional judgment and since this was a CCV that did not bracket any sample results, no sample qualifications were made.

6.3.3 CRDL (Detection Limit) Standard

The CRDL standards were within the control limits.

6.3.4 ICSA/ICSAB (Interference Check) Standards

The ICSA/ICSAB met all acceptance criteria.

6.4 Blanks

6.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria with the following exceptions; arsenic, chromium, lead and zinc were detected in the preparation blank at estimated concentrations less than the RL, but greater than the IDL. Therefore, based on the samples' arsenic, chromium, lead and zinc estimated concentrations which are less than the RL but greater than the IDL, the sample estimated concentrations are U qualified as not detected at the RL.

Sample	Metal	Laboratory Estimated concentration (ug/L)	Validation Concentration (ug/L)
OU1-SS-SB308-26.5-27.5	Chromium	2.3 B	3.0 U
OU1-SS-SB309-48-49	Arsenic	0.198 B	1.0 U
	Chromium	0.779 B	3.0 U
	Lead	0.291 B	1.0 U
OU1-SS-SB309-28.5-29.5	Chromium	0.899 B	3.0 U
	Lead	0.305 B	1.0 U
OU1-SS-SB406-0-1	Chromium	0.885 B	3.0 U
	Lead	0.227 B	1.0 U
OU1-SS-SB305-90-91	Arsenic	0.382 B	1.0 U
	Chromium	0.968 B	3.0 U
	Lead	0.281 B	1.0 U

6.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria with a few exceptions; several ICBs and CCBs had metal detections at estimated concentrations less than the RL, but greater than the IDLs. However, based on professional judgment and since the metals concentrations in the associated samples were either greater than RL or not detected, no additional sample qualifications were made.

6.5 Laboratory Control Samples (LCS)

All percent recoveries in the LCS were within the acceptance limits.

6.6 Matrix Spike (MS)

Samples OU1-SS-SB309-48-49 and OU1-SS-SB309-28.5-29.5 were analyzed as the MSs. All compound recoveries were within the laboratory control limits, with the

exception of low calcium recoveries in both MSs. However, since the concentration of calcium in both unspiked samples exceeded the spike concentration by a factor of four or greater, the spike recovery control limits do not apply and qualification of the data is not required.

6.7 Laboratory Duplicate Samples

Samples OU1-SS-SB309-48-49 and OU1-SS-SB309-28.5-29.5 were analyzed as the laboratory duplicates. The relative percent differences (RPD) were within the acceptance limits, with the following exceptions. Iron, mercury and vanadium were outside of the acceptance limits in the duplicate of sample OU1-SS-SB309-48-49; however, since the concentrations of iron, mercury and vanadium in both the sample and duplicate were less than the RL, no sample qualifications are required. Mercury and vanadium were outside of the acceptance limits in the duplicate of sample OU1-SS-SB309-28.5-29.5; however, since the concentrations of mercury and vanadium in both the sample and duplicate were less than the RL, no sample qualifications are required.

6.8 Serial Dilutions

The percent differences for the compounds for the serial dilution for the SPLP analysis of sample OU1-SS-SB309-48-49 were outside of the laboratory acceptance criteria for arsenic, cobalt, iron, magnesium, vanadium and zinc; however, since the concentrations of these metals are less than 50 times the IDL, no sample qualifications are required.

The percent differences for the compounds for the serial dilution for the SPLP analysis of sample OU1-SS-SB309-28.5-29.5 were outside of the laboratory acceptance criteria for aluminum, antimony, iron, selenium, silver and vanadium; however, since the concentrations of these metals are less than 50 times the IDL, no sample qualifications are required.

6.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits. It was erroneously noted in the laboratory report narrative that all SPLP samples had low internal standard recoveries, resulting in low biases for vanadium, chromium and cobalt. All samples analyzed for SPLP had acceptable internal standard recoveries; there is no low bias for any SPLP sample results based on internal standard recoveries.

The concentrations of some compounds in the samples were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the IDL. These concentrations are J qualified as estimated.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-SS-SB308-26.5-27.5	Cadmium	0.293 B	0.293 J
	Chromium	2.3 B	2.3 J
	Cobalt	0.108 B	0.108 J
	Mercury	0.189 B	0.189 J
	Nickel	1.6 B	1.6 J
	Potassium	653 B	653 J
	Vanadium	0.834 B	0.834 J
OU1-SS-SB309-48-49	Arsenic	0.198 B	0.198 J
	Chromium	0.779 B	0.779 J
	Cobalt	0.079 B	0.079 J
	Copper	0.858 B	0.858 J
	Iron	24.9 B	24.9 J
	Lead	0.291 B	0.291 J
	Nickel	0.698 B	0.698 J
	Potassium	920 B	920 J
	Vanadium	0.676 B	0.676 J
	Zinc	18.9 B	18.9 J
OU1-SS-SB309-28.5-29.5	Aluminum	52.0 B	52.0 J
	Antimony	14.3 B	14.3 J
	Chromium	0.899 B	0.899 J
	Iron	4.55 B	4.55 J
	Lead	0.305 B	0.305 J
	Mercury	0.028 B	0.028 J
	Potassium	1580 B	1580 J
	Selenium	0.582 B	0.582 J
	Silver	2.3 B	2.3 J
	Vanadium	0.457 B	0.457 J
OU1-SS-SB406-0-1	Antimony	15.1 B	15.1 J
	Cadmium	0.295 B	0.295 J
	Chromium	0.885 B	0.885 J
	Cobalt	0.671 B	0.671 J
	Iron	30.5 B	30.5 J
	Lead	0.227 B	0.227 J
	Mercury	0.024 B	0.024 J
	Potassium	636 B	636 J
	Selenium	0.537 B	0.537 J
	Vanadium	0.204 B	0.204 J
OU1-SS-SB305-90-91	Aluminum	49.2 B	49.2 J
	Antimony	8.9 B	8.9 J
	Arsenic	0.382 B	0.382 J
	Chromium	0.968 B	0.968 J
	Iron	55.2 B	55.2 J
	Lead	0.281 B	0.281 J
	Mercury	0.029 B	0.029 J
	Thallium	0.044 B	0.044 J

7.0 Cyanide (EPA Method 9012), pH (EPA Method 9045) and Percent Solids (Modified Method 160.3)

The soil samples were analyzed for cyanide (EPA Method 9012), pH, (EPA Method 9045) and percent solids (EPA Modified Method 160.3). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review. In addition, the percent solids data was reviewed and found to be acceptable.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ⊗ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ Laboratory Control Sample
- ✓ Matrix Spike Sample
- ✓ Laboratory Duplicate Sample

7.1 Data Completeness

All analyses were performed as requested on the COC.

7.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

7.3 Calibrations

7.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for Cyanide analysis.

7.3.2 Continuing Calibration Verification (CCV)

The percent recoveries in all associated CCVs were within the QC acceptance limits for Cyanide.

7.4 Blanks

7.4.1 Preparation (Method) Blank

The preparation blank met the acceptance criteria; Cyanide was not detected in the method blank.

7.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICB and CCBs met the acceptance criteria; no Cyanide was detected in either the ICB or CCBs.

7.5 Laboratory Control Sample (LCS)

The cyanide percent recoveries in the LCSs (water and soil) were within the acceptance limits (85-115% recovery).

7.6 Matrix Spike (MS)

Sample OU1-SS-SB309-48-49 was analyzed as the MS. The recovery of cyanide was within the laboratory acceptance limits.

7.7 Laboratory Duplicate Samples

Sample OU1-SS-SB309-48-49 was analyzed as the laboratory duplicate. Cyanide was not detected in either the original sample or the duplicate.

ATTACHMENT A
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by GeoSyntec's Data Review Team

DATA QUALIFIER DEFINITIONS

- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Memorandum

TO: Nandra Weeks

DATE: March 10, 2008

FROM: Geosyntec Consultants QA/QC Group

SITE: Mattheissen and Hegeler Zinc Company Site, OU1

SUBJECT: Summary of Tier III Validation of analytical results for CAS Report R2740512

Introduction

This report summarizes the findings of the full validation of three soil samples, four equipment blanks and one trip blank collected on behalf of the Mattheissen and Hegeler Zinc Company Site, OU1 project. These samples were collected on October 24-25, 2007. The samples were analyzed by Columbia Analytical Services, Inc. (CAS), Rochester, New York. The samples were analyzed for Volatile Organic Compounds by EPA Method 8260B, Semivolatile Organic Compounds by EPA Method 8270C, Organochlorine Pesticides by EPA Method 8081A, Polychlorinated Biphenyls (PCBs) by EPA Method 8082, Total Metals by EPA Methods 6020 and 6010B, Mercury by EPA Methods 7470A and 7471A, Metals by EPA Methods 6020, 6010 and 7470A following EPA Method 1312 Synthetic Precipitation Leaching Procedure (SPLP), Cyanide by EPA Method 9012, pH by EPA Method 9045 and Percent Solids by Modified EPA Method 160.3.

The data were reviewed in accordance with the principles presented in *USEPA National Functional Guidelines for Laboratory Data Review, Organics* (EPA, 2005), *USEPA National Functional Guidelines for Laboratory Data Review, Inorganics* (EPA, 2004), and per the requirements of the QAPP, the laboratory standard operating procedures and the specified methods.

Data for the following samples were reviewed.

CAS Job No.	Client ID
1049297	OU1-SS-SB307-0-1 MS/MSD
1049298	OU1-SS-SB307-7-8
1049299	OU1-SS-SB307-7-8
1049300	OU1-SS-SB406-0-1
1049301	OU1-SW-MW402

1049302	OU1-SW-MW401-B
1049303	OU1-SW-MW401-A
1049304	OU1-SW-MW401-C
1049305	OU1-SW-MW401-B
1049306	OU1-SW-MW401-C
1049307	OU1-SW-MW401-B
1049308	OU1-SW-MW401-A
1049309	OU1-SW-MW401-C
1049310	OU1-SW-MW401-D
1049363	OU1-SS-SB307-0-1

Matrix – soil, 1 aqueous trip blank and 4 aqueous equipment blanks

Executive Summary

All analyses were performed as requested on the chain of custody (COC). The dates of sample collection were recorded on the COC using only the month and day; the year was not included in the date. It was assumed, based on the date of sample receipt at the laboratory, that the year was 2007.

All holding times were met.

1.0 Volatile Organic Compounds (EPA Method 8260B)

Full validation including recalculation was performed with the laboratory data for the analysis of volatile organic compounds (EPA Method 8260B). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ⊗ Internal Standards
- ✓ Performance Check Sample
- ⊗ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ⊗ Matrix Spike/Matrix Spike Duplicate Sample
- ⊗ Laboratory Control Samples
- ✓ Compound Identification and Quantitation

1.1 Data Completeness

All analyses were performed as requested on the COC.

1.2 Holding Times and Preservation

All samples were analyzed within the 14 day technical holding time from date of collection for volatiles.

1.3 Calibrations

1.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the percent relative standard deviation (%RSD) of the relative response factors (RRFs). For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

1.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method or validation acceptance criteria.

1.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts, with the following exceptions. Internal standard recoveries for dichlorobenzene-d5 in sample OU1-SS-SB307-7-8 and dichlorobenzene-d5 and Chlorobenzene-d5 in the reanalysis of sample OU1-SS-SB307-7-8 were low and outside of the method acceptance limits. Therefore, the undetected concentrations of the associated compounds are R qualified as rejected and the concentrations detected are J qualified as estimated.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-SB307-7-8	1,2-Dibromo-3-chloropropane	6.8 U	6.8 R
	1,3-Dichlorobenzene	6.8 U	6.8 R
	1,4-Dichlorobenzene	6.8 U	6.8 R
	1,2-Dichlorobenzene	6.8 U	6.8 R
	1,1,2,2-Tetrachloroethane	6.8 U	6.8 R
	1,2,4-Trichlorobenzene	6.8 U	6.8 R
OU1-SS-SB307-7-8 (reanalysis)	Bromoform	7.7 U	7.7 R
	Chlorobenzene	7.7 U	7.7 R
	1,2-Dibromo-3-chloropropane	7.7 U	7.7 R
	Dibromochloromethane	7.7 U	7.7 R
	1,2-Dibromoethane	7.7 U	7.7 R
	1,3-Dichlorobenzene	7.7 U	7.7 R
	1,4-Dichlorobenzene	7.7 U	7.7 R
	1,2-Dichlorobenzene	7.7 U	7.7 R
	Trans-1,3-dichloropropene	7.7 U	7.7 R
	Ethylbenzene	4.9 J	4.9 J
	2-Hexanone	15 U	15 R
	Isopropylbenzene	1.9 J	1.9 J
	4-Methyl-2-pentanone	15 U	15 R
	Styrene	7.7 U	7.7 R
	1,1,2,2-Tetrachloroethane	7.7 U	7.7 R
	Tetrachloroethene	7.7 U	7.7 R
	Toluene	9.3	9.3 J
	1,2,4-Trichlorobenzene	7.7 U	7.7 R
	1,1,2-Trichloroethane	7.7 U	7.7 R
	o-Xylene	7.1 J	7.1 J
	m+p-Xylene	9.6	9.6 J

1.5 Performance Check Samples

An instrument performance check sample (tune standard) was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for bromofluorobenzene (BFB).

1.6 Blanks

Acetone was detected in the method blank associated with the soil samples, at an estimated concentration greater than the method detection limit (MDL) but less than the reporting limit (RL). No sample qualifications were required for acetone because of the concentrations of acetone in the associated samples are greater than the RL.

Sample OU1-SW-MW-402 (collected 10/24/07) is the trip blank and samples OU1-SW-MW-401-A (collected 10/24/07), OU1-SW-MW-401-B (collected 10/25/07) and OU1-SW-MW-401-C (collected 10/25/07) are the equipment blanks. Acetone was detected in each of these blanks at estimated concentrations less than the RL, but greater than the MDL. No soil sample qualifications were required, based on the concentrations of acetone in the associated samples which are greater than the RL.

1.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

1.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits, with the exception of high dichlorodifluoromethane recovery outside of the laboratory control limits in the LCS associated with the soil analysis. Since dichlorodifluoromethane was not detected in the soil sample, no sample qualification was required.

1.9 Matrix Spike/Matrix Spike Duplicate Sample (MS/MSD)

A MS/MSD pair was not analyzed.

1.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

2.0 **Semivolatile Organic Compounds (EPA Method 8270C)**

Full validation including recalculation was performed on the laboratory data for the analysis of semivolatile organic compounds (EPA Method 8270C). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ⊗ Calibrations
- ✓ Internal Standards
- ⊗ Performance Check Sample
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples

- ✓ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

2.1 Data Completeness

All analyses were performed as requested on the COC.

2.2 Holding Times and Preservation

The samples for semivolatile analysis were extracted within the 7 day technical holding time (waters) and 14 day technical holding time (soil) from date of collection and analyzed with the 40 day technical holding time from date of extraction.

2.3 Calibrations

2.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the RRFs. For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

2.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria, with the following exception. Benzaldehyde in the CCV associated with samples OU1-SW-MW401-B, OU1-SW-MW401-A and OU1-SW-MW401-C was outside of the method acceptance criteria with a low bias. Therefore, the undetected concentrations of benzaldehyde in samples OU1-SW-MW401-B, OU1-SW-MW401-A and OU1-SW-MW401-C are UJ qualified as estimated below the RL.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-SW-MW401-B	Benzaldehyde	9.8 U	9.8 UJ
OU1-SW-MW401-A	Benzaldehyde	9.4 U	9.4 UJ
OU1-SW-MW401-C	Benzaldehyde	9.8 U	9.8 UJ

2.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts.

2.5 Performance Check Samples

An instrument performance check sample was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the

12-hour period. All ion abundance criteria were met for decafluorotriphenylphosphine (DFTPP). It was noted that on all 5B Forms, the percent relative abundances for mass 441 compared to mass 443 were wrong. However, the raw data confirmed that mass 441 passed the method criteria; therefore, no sample qualifications were required. The laboratory was notified of the error.

2.6 Blanks

There were no detections of the project compounds of concern in the laboratory method blanks.

Samples OU1-SW-MW401-B, OU1-SW-MW401-A, OU1-SW-MW401-C and OU1-SW-MW401-D were the equipment blanks. No compounds were detected in the equipment blanks.

2.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

2.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits.

2.9 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

A MS/MSD pair was not analyzed.

2.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

3.0 **Organochlorine Pesticides (EPA Method 8081A)**

Full validation including recalculation was performed on the laboratory data for the analysis of Organochlorine Pesticides (EPA Method 8081A). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate
- ⊗ Compound Identification and Quantitation

3.1 Data Completeness

All analyses were performed as requested on the COC.

3.2 Holding Times and Preservation

The samples for organochlorine pesticide analysis were extracted within the 7 day technical holding time (waters) and 14 day technical holding time (soil) from date of collection and analyzed within the 40 day technical holding time from date of extraction.

3.3 Calibrations

3.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the average response factors (RFs). For all target analytes, the RSDs met the method criteria for all compounds.

3.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the percent differences (%D) between the average RFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

3.4 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

Samples OU1-SW-MW401-A and OU1-SW-MW401-B were the equipment blanks. No compounds were detected in the equipment blanks.

3.5 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

3.6 Laboratory Control Samples (LCS)

All LCS/LCS duplicate (LCSD) recoveries and RPDs were within the laboratory control limits.

3.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Sample OU1-SS-SB307-0-1 was analyzed as the MS/MSD. All compound recoveries were within the laboratory control limits, with the following exceptions. Aldrin recovery in the MSD was high and above the laboratory control limits. However, since aldrin was not detected in sample OU1-SS-SB307-0-1, no sample qualifications were required. The recoveries of endrin aldehyde were 1.1% and 178% on the two columns used for analysis; based on professional judgment these recoveries indicate matrix interferences. Therefore, the concentration of endrin aldehyde in sample OU1-SS-SB307-0-1 is UJ qualified as estimated less than the RL.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB307-0-1	Endrin aldehyde	3.7 U	3.7 UJ

3.8 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate, with the following exceptions.

The beta endosulfan concentration in sample OU1-SS-SB307-0-1 was reported by the laboratory as not detected at 3.7 ug/kg. However, based on the raw data and email communication from the laboratory, the undetected concentration of beta endosulfan in sample OU1-SS-SB307-0-1 is 4.8 ug/kg, due to baseline noise. The concentration of beta endosulfan on a second column resulted in a sample detection limit of 3.9 ug/kg. The higher of the two concentrations is reported as the detection limit in the sample, based on the laboratory's reporting procedure and professional judgment. An elevated RL was calculated and reported as a result of the validation process and summarized below.

The endosulfan sulfate concentration in sample OU1-SS-SB307-0-1 was reported by the laboratory as not detected at 3.7 ug/kg. However, based on the raw data and email communication from the laboratory, the undetected concentration of endosulfan sulfate in sample OU1-SS-SB307-0-1 is 3.9 ug/kg, due to baseline noise. The concentration of endosulfan sulfate on a second column resulted in a sample detection limit of 1.57 ug/kg, which is less than the RL, but greater than the MDL. The RPD between the two results is 86%, which suggests that a chromatographic problem may exist, due to matrix interference. The higher of the two concentrations is reported as the detection limit in the sample, based on the laboratory's reporting procedure and professional judgment. An elevated RL was calculated and reported as a result of the validation process and summarized below.

The beta-BHC concentration in sample OU1-SS-SB307-0-1 was reported by the laboratory as not detected at 1.9 ug/kg. However, based on the raw data and professional judgment, the undetected concentration of beta-BHC in sample OU1-SS-SB307-0-1 is 8.8 mg/kg, due to baseline noise. The concentration of beta-BHC on a second column resulted in a sample detection limit of 0.34 ug/kg, which is less than the RL, but greater than the MDL. The RPD between the two results is 185%, which suggests that a chromatographic problem may exist, due to matrix interference. The higher of the two concentrations is reported as the detection limit in the sample, based on the laboratory's reporting procedure and professional judgment. An elevated RL was calculated and reported as a result of the validation process and summarized below.

The endrin concentration in sample OU1-SS-SB307-0-1 was reported by the laboratory as not detected at 3.7 ug/kg. However, based on the raw data and professional judgment, the undetected concentration of endrin in sample OU1-SS-SB307-0-1 is 5.0 mg/kg, due to baseline noise. The concentration of endrin on a second column resulted in a sample detection limit of 1.16 ug/kg, which is less than

the RL, but greater than the MDL. The RPD between the two results is 124%, which suggests that a chromatographic problem may exist, due to matrix interference. The higher of the two concentrations is reported as the detection limit in the sample, based on the laboratory's reporting procedure and professional judgment. An elevated RL was calculated and reported as a result of the validation process and summarized below.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB307-0-1	beta-Endosulfan	3.7 U	4.8 U
	Endosulfan sulfate	3.7 U	3.9 U
	beta-BHC	1.9 U	8.8 U
	Endrin	3.7 U	5.0 U

It was noted that J qualified concentrations (sample concentrations between the MDL and RL) were not reported by the laboratory.

4.0 PCBs (EPA Method 8082)

Full validation including recalculation was performed on the laboratory data for the analysis of PCBs (EPA Method 8082). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ✓ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

4.1 Data Completeness

All analyses were performed as requested on the COC.

4.2 Holding Times and Preservation

The samples for PCB analysis were extracted within the 7 day technical holding time (water) and 14 day technical holding time (soil) from date of collection and analyzed within the 40 day technical holding time from date of extraction.

4.3 Calibrations

4.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the average response factors (RFs). For all target analytes, the RSDs met the method criteria for all compounds.

4.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the percent differences (%D) between the average RFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

4.4 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

Samples OU1-SW-MW401-A and OU1-SW-MW401-B were the equipment blanks. No compounds were detected in the equipment blanks.

4.5 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

4.6 Laboratory Control Samples (LCS)

All LCS/LCS duplicate (LCSD) recoveries and RPDs were within the laboratory control limits.

4.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Sample OU1-SS-SB307-0-1 was analyzed as the MS/MSD. All compound recoveries were within the laboratory control limits.

4.8 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

5.0 Metals (EPA Methods 6020/6010B/7470A/7471A)

The soil and water samples were analyzed for the requested metals and Mercury (EPA 6020/6010B/7470A/7471A) following total metals digestion and Mercury digestion. Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation

- ✓ Calibrations
- ⊗ Blanks
- ⊗ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ⊗ Laboratory Duplicate Samples
- ⊗ Serial Dilutions
- ⊗ Compound Identification and Quantitation

5.1 Data Completeness

All analyses were performed as requested on the COC.

5.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

5.3 Calibrations

5.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

5.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits, with the following exception. Aluminum was slightly high (111%, limits 90-110%) and outside of the QC acceptance limits in the closing CCV for the soil analyses; however, based on professional judgment, no sample qualifications were made.

5.3.3 CRDL (Detection Limit) Standard

The CRDL standards were within the control limits, with the following exceptions. Iron recovery was high and slightly outside of the acceptance limits in the closing CRDL for the water analyses (134%, limits 70-130%). Zinc recovery was high and slightly outside of the acceptance limits in the closing CRDL for the soil analyses (131%, limits 70-130%). However, based on professional judgment and due to the sample concentrations greater than the RL, no sample qualifications were made.

5.3.4 ICSA/ICSAB (Interference Check) Standards

The ICSA/ICSAB standards met all acceptance criteria.

5.4 Blanks

5.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria with the following exceptions; chromium, copper, iron, lead, manganese, sodium, vanadium and zinc were detected in the water preparation blank at estimated concentrations less than the RL but greater than the instrument detection limits (IDL). The concentrations of copper and zinc in the associated water sample were greater

than the RL; therefore, no sample qualifications were required for copper and zinc. However, the estimated concentrations of chromium, iron, lead, manganese and sodium detected in the associated sample less than the RL but greater than the IDL are U qualified as not detected at the RL; the concentration of vanadium is U qualified as not detected at an elevated RL, based on professional judgment.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-SW-MW401-A	Chromium	1.6 B	3.0 U
	Iron	34.2 B	100 U
	Lead	0.655 B	1.0 U
	Manganese	3.7 B	10 U
	Sodium	119 B	5000 U
	Vanadium	1.3	1.3 U

Calcium, lead manganese and sodium were detected in the soil preparation blank at estimated concentrations less than the RL, but greater than the IDL. However, no sample qualifications were made to the calcium, lead and manganese concentrations since the concentrations in the associated samples were greater than the RL. The concentrations of sodium in the associated samples were at least ten times the preparation blank sodium concentration; therefore, based on professional judgment, no sample qualifications were made to the sodium sample concentrations.

5.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria with a few exceptions; several ICBs and CCBs had metal detections at estimated concentrations less than the RL, but greater than the IDLs. However, since the metals concentrations for all metals except sodium (soil samples) in the associated samples were either greater than the RL or not detected, no additional sample qualifications were made. The concentrations of sodium in the associated soil samples were at least ten times the ICB and CCB blank sodium concentrations; therefore, based on professional judgment, no sample qualifications were made to the sodium sample concentrations based on the ICBs and CCBs.

5.4.3 Field QC Samples

Sample OU1-SW-MW-401A is the equipment blank. The following compounds were detected in OU1-SW-MW-401A at estimated concentrations less than the RL, but greater than the IDL. No soil sample qualifications were required, based on these estimated detections and the concentrations of the metals in the associated samples.

OU1-SW-MW-401A – barium, calcium, chromium, iron, lead, manganese, nickel and sodium.

The following compounds were detected in OU1-SW-MW-401A at concentrations greater than the RL:

OU1-SW-MW-401A – copper, vanadium and zinc

Based on professional judgment, no sample qualifications were made to the soil samples, based on these detections since the concentrations of the metals in the soil samples were much higher than the equipment blank concentrations.

5.5 Laboratory Control Samples (LCS)

All percent recoveries in the water LCS were within the acceptance limits.

All percent recoveries in the soil LCS were within the acceptance limits, with the following exceptions. Antimony, cobalt, lead and thallium had high recoveries, outside of the acceptance limits in the LCS. Therefore, the concentrations of antimony, cobalt, lead and thallium in the associated samples are J+ qualified as estimated with a high bias.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB307-0-1	Antimony	10.2	10.2 J+
	Cobalt	6.0	6.0 J+
	Lead	393	393 J+
	Thallium	0.592 B	0.592 J+
OU1-SS-SB307-7-8	Antimony	2.9 B	2.9 J+
	Cobalt	6.1	6.1 J+
	Lead	90.8	90.8 J+
	Thallium	0.430 B	0.430 J+
OU1-SS-SB307-8-9	Antimony	3.3 B	3.3 J+
	Cobalt	11.9	11.9 J+
	Lead	88.5	88.5 J+
	Thallium	0.694 B	0.694 J+
OU1-SS-SB406-0-1	Antimony	4.5 B	4.5 J+
	Cobalt	7.8	7.8 J+
	Lead	135	135 J+
	Thallium	0.664 B	0.664 J+

5.6 Matrix Spike (MS)

Sample OU1-SW-MW401-A was analyzed as the water MS. Only the metals analyzed by EPA Method 6010B were spiked; all compound recoveries were within the laboratory control limits.

The metals analyzed by EPA Method 6020 for waters were spiked into a batch QC sample. No information was provided on the batch QC sample results.

Sample OU1-SS-SB307-0-1 was analyzed as the soil MS. The following compounds were outside of the laboratory control limits: Aluminum, arsenic, barium, cadmium, calcium, chromium, iron, lead, magnesium, manganese, mercury, nickel, vanadium and zinc. However, since the concentration of these metals in the unspiked sample exceeded the spike concentration by a factor of four or greater, the spike recovery control limits do not apply and qualification of the data is not required. The recoveries for antimony and selenium were low and outside of the laboratory control limits; therefore, the concentrations of antimony and selenium in sample OU1-SS-SB307-0-1 are J- qualified as estimated with a low bias.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB307-0-1	Antimony	10.2	10.2 J-
	Selenium	0.638 B	0.638 J-

5.7 Laboratory Duplicate Samples

Sample OU1-SW-MW401-A was analyzed as the water laboratory duplicate. Only the metals analyzed by EPA Method 6010B were assessed in the laboratory duplicate. All RPD results were acceptable, with the exception of iron. However, since iron was detected at a estimated concentration less than the RL, but greater than the IDL, no sample qualifications were required.

The metals analyzed by EPA Method 6020 for waters were assessed using a batch QC sample. No information was provided on the batch QC sample results.

Sample OU1-SS-SB307-0-1 was analyzed as the soil laboratory duplicate. The following metals were outside of the laboratory acceptance limits for RPD: antimony, arsenic, barium, lead, mercury, sodium, vanadium and zinc. No sample qualifications are required for antimony and sodium since the concentrations in the duplicate are less than the RL. However, due to the duplicate RPDs outside of the acceptance limits, the concentrations of arsenic, barium, lead, mercury, vanadium and zinc are J qualified as estimated.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB307-0-1	Arsenic	16.9	16.9 J
	Barium	612	612 J
	Lead	393	393 J
	Mercury	1.1	1.1 J
	Vanadium	27.9	27.9 J
	Zinc	3110	3110 J

5.8 Serial Dilutions

The percent differences for the compounds for the serial dilution for the total metals water analysis of sample OU1-SW-MW401-A were outside of the laboratory acceptance criteria for calcium, chromium, iron, lead, magnesium, manganese,

potassium, sodium, vanadium and zinc; however, these metals concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required. The serial dilution was only performed for the metals analyzed by EPA Method 6010B. The serial dilution for the metals analyzed by EPA Method 6020 for waters was assessed using a batch QC sample. No information was provided on the batch QC sample results.

The percent differences for the compounds for the serial dilution for the total metals soil analysis of sample OU1-SS-SB307-0-1 were outside of the laboratory acceptance criteria for antimony, iron and selenium; however, the antimony and selenium concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required. Based on the concentrations of iron in the original sample and serial dilution, the concentration of iron in sample OU1-SS-SB307-0-1 is J qualified as estimated.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-SB3079-0-1	Iron	34300	34300 J

5.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

The concentrations of some compounds in the samples were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the IDL. These concentrations are J qualified as estimated.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-SW-MW401A	Barium	0.719 B	0.719 J
	Calcium	260 B	260 J
	Nickel	0.179 B	0.179 J

Sample	Metal	Laboratory Concentration (mg/kg)	Validation Concentration (mg/kg)
OU1-SS-SB307-0-1	Beryllium	1.0 B	1.0 J
	Selenium	0.638 B	0.638 J
	Sodium	399 B	399 J
	Thallium	0.592 B	0.592 J
OU1-SS-SB307-7-8	Antimony	2.9 B	2.9 J
	Mercury	0.030 B	0.030 J
	Selenium	0.557 B	0.557 J
	Sodium	338 B	338 J
	Thallium	0.430 B	0.430 J

OU1-SS-SB307-8-9	Antimony	3.3 B	3.3 J
	Selenium	1.3 B	1.3 J
	Sodium	367 B	367 J
	Thallium	0.694 B	0.694 J
OU1-SS-SB406-0-1	Antimony	4.5 B	4.5 J
	Selenium	0.774 B	0.774 J
	Thallium	0.664 B	0.664 J

6.0 SPLP Metals (EPA Methods 1312/6020/6010B/7470A)

The soil samples were analyzed for the requested metals and Mercury (EPA 6020/6010B/7470A) following a Synthetic Precipitation Leaching Procedure (SPLP). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ⊗ Blanks
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ✓ Laboratory Duplicate Samples
- ✓ Serial Dilutions
- ⊗ Compound Identification and Quantitation

6.1 Data Completeness

All analyses were performed as requested on the COC. The SPLP extraction log was requested from the laboratory and was sent by email.

6.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

6.3 Calibrations

6.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

6.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits.

6.3.3 CRDL Standard

The CRDL standards were within the control limits.

6.3.4 ICSA/ICSAB Standards

The ICSA/ICSAB met all acceptance criteria.

6.4 Blanks

6.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria with the following exceptions; arsenic, chromium, copper, lead, mercury and vanadium were detected in the preparation blank at estimated concentrations less than the RL but greater than the IDL. Therefore, based on the sample's chromium, copper, mercury and vanadium concentrations which are less than the RL but greater than the IDL, the sample concentrations are U qualified as not detected at the RL.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-SS-SB307-0-1	Chromium	2.1 B	3.0 U
	Copper	4.5 B	5.0 U
	Mercury	0.120 B	0.200 U
	Vanadium	0.743 B	1.0 U

6.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria with a few exceptions; several ICBs and CCBs had metal detections at estimated concentrations less than the RL, but greater than the IDLs. However, based on professional judgment and since the metals concentrations in the associated samples were either greater than the RL or not detected, no additional sample qualifications were made.

6.5 Laboratory Control Samples (LCS)

All percent recoveries in the LCS were within the acceptance limits.

6.6 Matrix Spike (MS)

Sample OU1-SS-SB307-0-1 was analyzed as the MS. All compound recoveries were within the laboratory control limits. Only the metals analyzed by EPA Method 6020 were assessed in the MS. The metals analyzed by EPA Method 6010B were assessed using a batch QC sample. No information was provided on the batch QC sample results.

6.7 Laboratory Duplicate Samples

Sample OU1-SS-SB307-0-1 was analyzed as the laboratory duplicates. The relative percent differences (RPD) were within the acceptance limits, with the following exceptions. Thallium and vanadium were outside of the acceptance limits in the duplicate of sample OU1-SS-SB307-0-1; however, since the estimated concentrations of thallium and vanadium in the sample were less than the RL, no sample qualifications are required. Only the metals analyzed by EPA Method 6020 were assessed in the duplicate. The metals analyzed by EPA Method 6010B were assessed using a batch QC sample. No information was provided on the batch QC sample results.

6.8 Serial Dilutions

The percent differences for the compounds for the serial dilution for the SPLP analysis of sample OU1-SS-SB307-0-1 were outside of the laboratory acceptance criteria for arsenic, chromium, copper, potassium, selenium, thallium and vanadium; however, since the concentrations of these metals are less than 50 times the IDL, no sample qualifications are required.

6.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

The concentrations of some compounds in the sample were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the IDL. These concentrations are J qualified as estimated.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-SS-SB307-0-1	Cadmium	0.681 B	0.681 J
	Cobalt	0.316 B	0.316 J
	Nickel	2.3 B	2.3 J
	Potassium	934 B	934 J
	Selenium	0.636 B	0.636 J
	Thallium	0.063 B	0.063 J

7.0 Cyanide (EPA Method 9012), pH (EPA Method 9045) and Percent Solids (Modified Method 160.3)

The soil and water samples were analyzed for cyanide (EPA Method 9012), pH, (EPA Method 9045) and percent solids (EPA Modified Method 160.3). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review. In addition, the percent solids data was reviewed and found to be acceptable.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where

issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ Laboratory Control Sample
- ✓ Matrix Spike Sample
- ✓ Laboratory Duplicate Sample

7.1 Data Completeness

All analyses were performed as requested on the COC.

7.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

7.3 Calibrations

7.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for Cyanide analysis.

7.3.2 Continuing Calibration Verification (CCV)

The percent recoveries in all associated CCVs were within the QC acceptance limits for Cyanide.

7.4 Blanks

7.4.1 Preparation (Method) Blank

The preparation blank met the acceptance criteria; Cyanide was not detected in the method blank.

7.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICB and CCBs met the acceptance criteria; no Cyanide was detected in either the ICB or CCBs.

7.5 Laboratory Control Sample (LCS)

The cyanide percent recoveries in the LCSs (water and soil) were within the acceptance limits (85-115% recovery).

7.6 Matrix Spike (MS)

An MS from this sample set was not analyzed. Results of batch QC analyses were not reported.

7.7 Laboratory Duplicate Samples

A duplicate from this sample set was not analyzed. Results of batch QC analyses were not reported.

ATTACHMENT A
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by GeoSyntec's Data Review Team

DATA QUALIFIER DEFINITIONS

- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Memorandum

TO: Nandra Weeks

DATE: March 10, 2008

FROM: Geosyntec Consultants QA/QC Group

SITE: Mattheissen and Hegeler Zinc Company Site, OU1

SUBJECT: Summary of Tier III Validation of analytical results for CAS Report R2740626

Introduction

This report summarizes the findings of the full validation of twenty five soil samples, five trip blanks and 5 equipment blank samples collected on behalf of the Mattheissen and Hegeler Zinc Company Site, OU1 project. These samples were collected on October 24, 29, 30, 31 and November 1, 2007. The samples were analyzed by Columbia Analytical Services, Inc. (CAS), Rochester, New York. The samples were analyzed for Volatile Organic Compounds by EPA Method 8260B, Semivolatile Organic Compounds by EPA Method 8270C, Organochlorine Pesticides by EPA Method 8081A, Polychlorinated Biphenyls (PCBs) by EPA Method 8082, Total Metals by EPA Methods 6020 and 6010B, Total Mercury by EPA Methods 7470A and 7471A, Cyanide by EPA Method 9012A and Percent Solids by Modified EPA Method 160.3.

The data were reviewed in accordance with the principles presented in *USEPA National Functional Guidelines for Laboratory Data Review, Organics* (EPA, 2005), *USEPA National Functional Guidelines for Laboratory Data Review, Inorganics* (EPA, 2004), and per the requirements of the QAPP, the laboratory standard operating procedures and the specified methods.

Data for the following samples were reviewed.

Lab ID	Client ID
1050401	OUI-SW-LVR205-071030
1050411	OUI-SW-LVR201-071029
1050415	OUI-SW-LVR406-071029
1050420	OUI-SW-MW402
1050422	OUI-SW-MW402
1050423	OUI-SW-MW402B
1050426	OUI-SW-LVR203-071030

1050428	OUI-SW-MW402C
1050433	OUI-SS-LVR203-071030
1050447	OUI-SS-LVR206-071030
1050448	OUI-SS-LVR207-071030
1050449	OUI-SS-LVR208-071030
1050450	OUI-SS-LVR204-071030
1050451	OUI-SS-LVR202-071030
1050455	OUI-SS-LVR201-071029
1050457	OUI-SS-LVR406-071029
1050775	OUI-SS-LVR205-071030
1050776	OUI-SS-LVR214-071031
1050777	OUI-SS-LVR209-071031
1050778	OUI-SS-LVR214-071031
1050779	OUI-SS-LVR213-071031
1050780	OUI-SS-LVR205-071030
1050781	OUI-SS-LVR209-071031
1050782	OUI-SS-LVR211-071031
1050783	OUI-SS-LVR212-071031
1050784	OUI-SS-LVR210-071031
1050785	OUI-SW-LVR209-071031
1050786	OUI-SW-MW402
1050787	OUI-SW-LVR211-071031
1050788	OUI-SW-LVR209-071031
1051235	OUI-SS-LVR213-071031
1051236	OU1-SE-UL215-071101
1051237	OU1-SW-LVR213-071031
1051238	OU1-SW-LVR214-071031
1051239	OU1-SW-MW402
1051240	OU1-SW-MW402
1051241	OU1-SW-MW401A
1051242	OU1-SW-MW401
1051243	OU1-SW-MW401B
1051244	OU1-SW-MW401C
1051245	OU1-SW-MW401D

Matrix – soil, 5 aqueous trip blanks and 5 aqueous equipment blanks

Executive Summary

All analyses were performed as requested on the chain of custody (COC). Incorrect error correction was observed on the COC instead of the proper procedure of a single strike through, correction, and initials and date of person making the correction.

There are some discrepancies throughout the lab report on the client IDs that the lab used compared to the COC forms. The following client ID in the laboratory report for laboratory ID

4080411 does not match the client ID on the COC. The laboratory used OU1-SW-LV201-071029; the COC lists the ID as OU1-SW-LVR201-071029. The following client ID in the laboratory report for laboratory ID 4080401 does not match the client ID on the COC. The laboratory used OU1-SW-LV205-071030; the COC lists the ID as OU1-SW-LVR205-071030. The following client ID in the laboratory report for laboratory ID 4080415 does not match the client ID on the COC. The laboratory used OU1-SW-LV406-071029; the COC lists the ID as OU1-SW-LVR406-071029. These client IDs were changed by the laboratory and new forms were emailed.

There are two samples on the COC with the same ID, OU1-SS-LVR206-0071030. One was collected 10/30/07, 1535 and given lab ID 1050447. The one collected 10/30/07, 1500 was given the lab ID 10540448. This second one was identified in the lab report as OUI-SS-LVR207-071030, based on email communication between CAS and the client.

All holding times were met.

1.0 Volatile Organic Compounds (EPA Method 8260B)

Full validation including recalculation was performed with the laboratory data for the analysis of volatile organic compounds (EPA Method 8260B). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ⊗ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Internal Standards
- ✓ Performance Check Sample
- ⊗ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ⊗ Matrix Spike/Matrix Spike Duplicate Sample
- ✓ Laboratory Control Samples
- ⊗ Compound Identification and Quantitation

1.1 Data Completeness

All analyses were performed as requested on the COC.

Soil samples OUI-SS-LVR213-071031 (both original and dilution), OUI-SS-LVR209-071031 were not reported on a dry weight basis in the laboratory report. Revised report forms with the sample results on a dry weight basis were requested and received from the lab by email. In addition, incomplete extraction records were in the laboratory report. Complete extraction records were requested and received from the laboratory by email.

1.2 Holding Times and Preservation

All samples were analyzed within the 14 day technical holding time from date of collection for volatiles.

1.3 Calibrations

1.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the percent relative standard deviation (%RSD) of the relative response factors (RRFs). For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

1.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method or validation acceptance criteria.

1.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts.

1.5 Performance Check Samples

An instrument performance check sample (tune standard) was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for bromofluorobenzene (BFB).

1.6 Blanks

Methylene chloride was detected in the method blank associated with the soil samples, at an estimated concentration greater than the method detection limit (MDL) but less than the reporting limit (RL). However, since methylene chloride was not detected in the associated samples, no sample qualifications were required.

2-Butanone was detected in the method blank associated with the dilution of sample OUI-SS-LVR213-071031, at a estimated concentration greater than the MDL but less than the RL. Therefore, the 2-butanone estimated concentration in sample OUI-SS-LVR213-071031 is U qualified as undetected at the RL.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OUI-SS-LVR213-071031	2-Butanone	240 JB	1500 U

Trip blanks were associated with the samples listed on the same COC. For example, the following samples are associated with trip blank OU1-SW-MW402, collection date 10/24/07, since these samples are listed on the same COC as this trip blank: OUI-SW-LV201-071029, OUI-SS-LVR201-071029 and OUI-SS-LVR406-071029.

Acetone was detected in the following trip blanks at estimated concentrations less than the RL, but greater than the MDL: OU1-SW-MW402, collected 10/30/07 (lab ID 1050420), OU1-SW-MW402, collected 10/24/07 (lab ID 1050422), OU1-SW-MW402, collected 10/31/07 (lab ID 1050786) and OU1-SW-MW402, collected 11/01/07 (lab ID 1051240). Therefore, based on the estimated concentration of acetone in the associated sample greater than the MDL but less than the RL, the concentration of acetone in the sample is U qualified as undetected at the RL. All other associated samples did not have acetone detected.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SE-UL215-071101	Acetone	3.2 J	20 U

1.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

1.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits.

1.9 Matrix Spike/Matrix Spike Duplicate Sample (MS/MSD)

Sample OU1-SW-LVR205-071030 was analyzed as the water MS/MSD. All compound recoveries and RPDs were within the laboratory control limits.

Sample OU1-SS-LVR205-071030 was analyzed as the soil MS/MSD. All compound recoveries and RPDs were within the laboratory control limits, with the following exceptions. Acetone and 2-butanone recoveries were high and outside of the laboratory control limits. Therefore, the concentrations of acetone and 2-butanone in sample OU1-SS-LVR205-071030 are J qualified as estimated.

The following compounds had low recoveries, slightly outside of the laboratory control limits: 1,2-dibromo-3-chloropropane, cis-1,2-dichloropropene, trans-1,2-dichloropropene and o-xylene. However, based on professional judgment, no sample qualifications were made since the recoveries were just outside of the control limits.

The following compounds had low recoveries, outside of the laboratory control limits: bromoform, chlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichlorobenzene, 2-hexanone, styrene and 1,2,4-trichlorobenzene. Therefore, the concentrations of bromoform, chlorobenzene, 1,3-dichlorobenzene, 1,4-

dichlorobenzene, 1,2-dichlorobenzene, 2-hexanone, styrene and 1,2,4-trichlorobenzene in sample OU1-SS-LVR205-071030 are UJ qualified as estimated below the RL.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SS-LVR205-071030	Acetone	130	130 J
	Bromoform	7.6 U	7.6 UJ
	2-Butanone	27	27 J
	Chlorobenzene	7.6 U	7.6 UJ
	1,3-Dichlorobenzene	7.6 U	7.6 UJ
	1,4-Dichlorobenzene	7.6 U	7.6 UJ
	1,2-Dichlorobenzene,	7.6 U	7.6 UJ
	2-hexanone	15 U	15 UJ
	Styrene	7.6 U	7.6 UJ
	1,2,4-Trichlorobenzene	7.6 U	7.6 UJ

1.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate, with the following exceptions.

Sample OUI-SS-LVR213-071031 was analyzed both original (undiluted) and a second time at a dilution due to the concentration of acetone in the original sample, which was outside of the linear range of the calibration. The sample results for carbon disulfide, 1,2-dichlorobenzene and methyl acetate from the dilution of sample OUI-SS-LVR213-071031 did not agree with the original analysis of the sample. Therefore, based on professional judgment, the concentrations of carbon disulfide, 1,2-dichlorobenzene and methyl acetate in both the original and dilution analyses of sample OUI-SS-LVR213-071031 are UJ qualified as undetected less than the RL and J qualified as estimated.

Sample ID	Compound	Original Laboratory Result (ug/kg)	Validation Result (ug/kg)	Dilution Laboratory Result (ug/kg)	Validation Result (ug/kg)
OUI-SS-LVR213-071031	Carbon disulfide	6.8 J	6.8 J	51 J	51 J
	1,2-Dichlorobenzene	7.6 U	7.6 UJ	52 J	52 J
	Methyl acetate	1.4 J	1.4 J	410 J	410 J

2.0 Semivolatile Organic Compounds (EPA Method 8270C)

Full validation including recalculation was performed on the laboratory data for the analysis of semivolatile organic compounds (EPA Method 8270C). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ⊗ Calibrations
- ✓ Internal Standards
- ⊗ Performance Check Sample
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate
- ⊗ Compound Identification and Quantitation

2.1 Data Completeness

All analyses were performed as requested on the COC.

2.2 Holding Times and Preservation

The samples for semivolatile analysis were extracted within the 7 day (water) or 14 day (soil) technical holding time from date of collection and analyzed within the 40 day technical holding time from date of extraction.

2.3 Calibrations

2.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the RRFs. For all target analytes, the RRFs met the method criteria; the RSDs met the method or validation criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

2.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method or validation acceptance criteria, with the following exception. 2,4-Dinitrophenol in the CCV associated with samples OUI-SS-LVR214-071031, OUI-SS-LVR209-071031, OUI-SS-LVR213-071031 and OU1-SE-UL215-071101 was outside of the acceptance criteria. Therefore, the undetected concentrations of 2,4-

Dinitrophenol in samples OUI-SS-LVR214-071031, OUI-SS-LVR209-071031, OUI-SS-LVR213-071031 and OU1-SE-UL215-071101 are UJ qualified as estimated below the RL.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OUI-SS-LVR214-071031	2,4-Dinitrophenol	2000 U	2000 UJ
OUI-SS-LVR209-071031	2,4-Dinitrophenol	2100 U	2100 UJ
OUI-SS-LVR213-071031	2,4-Dinitrophenol	5800 U	5800 UJ
OU1-SE-UL215-071101	2,4-Dinitrophenol	15000 U	15000 UJ

2.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts.

2.5 Performance Check Samples

An instrument performance check sample was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for decafluorotriphenylphosphine (DFTPP). It was noted that on all 5B Forms, the percent relative abundances for mass 441 compared to mass 443 were wrong. However, the raw data confirmed that mass 441 passed the method criteria; therefore, no sample qualifications were required. The laboratory was notified of the error.

2.6 Blanks

There were no detections of the project compounds of concern in the laboratory method blanks.

Sample OU1-SW-MW401 is the equipment blank. No compounds were detected in the equipment blank.

2.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

2.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits, with the exception of benzaldehyde, which had high recoveries, outside of the laboratory control limits, in the soil and water LCS and LCSD. However, since benzaldehyde was not detected in any of the samples, no sample qualifications were required.

2.9 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Sample OU1-SW-LVR205-071030 was analyzed as the water MS/MSD. All compound recoveries and RPDs were within the laboratory control limits.

Sample OU1-SS-LVR205-071030 was analyzed as the soil MS/MSD. All compound recoveries were within the laboratory control limits, with the exception of high benzaldehyde recoveries in the MS/MSD and high fluoranthene recovery in the MSD. Since benzaldehyde was not detected in sample OU1-SW-LV205-071030, no sample qualifications were required. However, since fluoranthene was detected in sample OU1-SW-LV205-071030, the concentration is J qualified as estimated.

Sample ID	Compound	Laboratory Result (ug/kg)	Validation Result (ug/kg)
OU1-SW-LV205-071030	Fluoranthene	340 J	340 J

2.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

3.0 Organochlorine Pesticides (EPA Method 8081A)

Full validation including recalculation was performed on the laboratory data for the analysis of Organochlorine Pesticides (EPA Method 8081A). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ⊗ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ✓ Matrix Spike/Matrix Spike Duplicate
- ⊗ Compound Identification and Quantitation

3.1 Data Completeness

All analyses were performed as requested on the COC.

3.2 Holding Times and Preservation

The samples for organochlorine pesticide analysis were extracted within the 7 day (water) or 14 day (soil) technical holding time from date of collection and analyzed within the 40 day technical holding time from date of extraction.

3.3 Calibrations

3.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the average response factors (RFs). For all target analytes, the RSDs met the method criteria for all compounds.

3.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the percent differences (%D) between the average RFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

3.4 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

Sample OU1-SW-MW401 was the equipment blank. No compounds were detected in the equipment blank.

3.5 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits, with the exception of one high surrogate recovery (decachlorobiphenyl, DCB) in sample OU1-SE-UL215-071101. However, since the other surrogate recovery (tetrachloro-m-xylene, TCMX) was acceptable, no sample qualifications were required.

3.6 Laboratory Control Samples (LCS)

All LCS/LCS duplicate (LCSD) recoveries and RPDs were within the laboratory control limits.

3.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Sample OU1-SW-LVR205-071030 was analyzed as the water MS/MSD. All compound recoveries and RPDs were within the laboratory control limits.

Sample OU1-SS-LVR205-071030 was analyzed as the soil MS/MSD. All compound recoveries and RPDs were within the laboratory control limits.

3.8 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate, with the following exceptions.

The dieldrin concentration in sample OU1-SE-UL215-071101 was reported by the laboratory as not detected at the RL. However, based on the raw data and recalculation during the validation process, the sample detection limit is 51 ug/kg, due to baseline noise. The concentration of dieldrin on a second column resulted in a sample detection limit of 23 ug/kg. The RPD between the two results is 89%, which suggests that a chromatographic problem may exist, due to matrix interference. The

higher of the two concentrations is reported as the detection limit in the sample, based on the laboratory's reporting procedure and professional judgment.

The concentration of endrin aldehyde in sample OU1-SE-UL215-071101 was reported by the laboratory as not detected at the RL. However, based on the raw data and recalculation during the validation process, the sample detection limit is 101 ug/kg, due to baseline noise. The concentration of endrin aldehyde on a second column resulted in a sample detection limit of 58 ug/kg. The RPD between the two results is 54%, which suggests that a chromatographic problem may exist, due to matrix interference. The higher of the two concentrations is reported as the detection limit in the sample, based on the laboratory's reporting procedure and professional judgment.

The concentration of endrin ketone in sample OU1-SE-UL215-071101 was reported by the laboratory as not detected at the RL. However, based on the raw data and recalculation during the validation process, the sample detection limit is 140 mg/kg. The concentration of endrin ketone on a second column resulted in a sample detection limit of 51 ug/kg. The RPD between the two results is 54%, which suggests that a chromatographic problem may exist, due to matrix interference. The higher of the two concentrations is reported as the detection limit in the sample, based on the laboratory's reporting procedure and professional judgment.

The concentration of heptachlor epoxide in sample OU1-SE-UL215-071101 was reported by the laboratory as not detected at the RL. However, based on the raw data and recalculation during the validation process, the sample detection limit is 10 mg/kg. The concentration of heptachlor epoxide on a second column resulted in a sample detection limit of 4.0 ug/kg. The RPD between the two results is 89%, which suggests that a chromatographic problem may exist, due to matrix interference. The higher of the two concentrations is reported as the detection limit in the sample, based on the laboratory's reporting procedure and professional judgment.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SE-UL215-071101	Dieldrin	4.8 U	51 U
	Endrin aldehyde	4.8 U	101 U
	Endrin ketone	4.8 U	140 U
	Heptachlor epoxide	2.5 U	10 U

It was noted that J qualified concentrations (sample concentrations between the MDL and RL) were not reported by the laboratory.

4.0 PCBs (EPA Method 8082)

Full validation including recalculation was performed on the laboratory data for the analysis of PCBs (EPA Method 8082). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ⊗ Calibrations
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ✓ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

4.1 Data Completeness

All analyses were performed as requested on the COC.

4.2 Holding Times and Preservation

The samples for PCB analysis were extracted within the 7 day (water) or 14 day (soil) technical holding time from date of collection and analyzed with the 40 day technical holding time from date of extraction.

4.3 Calibrations

4.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the average response factors (RFs). For all target analytes, the RSDs met the method criteria for all compounds.

4.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the percent differences (%D) between the average RFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria, with the following exceptions. Two closing CCVs had compounds with percent differences outside of the method acceptance limits. There were no PCBs detected in the associated samples, with the exception of PCB 1260 in sample OU1-SE-UL215-071101. Only one of the peaks used to quantify PCB1260 in the CCV associated with sample OU1-SE-UL215-071101 was outside the acceptance limits. Therefore, based on professional judgment and since the instrument response increased, no sample qualifications were made.

4.4 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

Sample OU1-SW-MW401 was the equipment blank. No compounds were detected in the equipment blank.

4.5 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

4.6 Laboratory Control Samples (LCS)

All LCS/LCS duplicate (LCSD) recoveries and RPDs were within the laboratory control limits.

4.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Sample OU1-SW-LVR205-071030 was analyzed as the water MS/MSD. All compound recoveries and RPDs were within the laboratory control limits.

Sample OU1-SS-LVR205-071030 was analyzed as the soil MS/MSD. All compound recoveries and RPDs were within the laboratory control limits.

4.8 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

5.0 Metals (EPA Methods 6020/6010B/7470A/7471A)

The soil and water samples were analyzed for the requested metals and Mercury (EPA 6020/6010B/7470A/7471A) following total metals digestion and Mercury digestion. Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPS and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ⊗ Blanks
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ⊗ Laboratory Duplicate Samples
- ⊗ Serial Dilutions
- ⊗ Compound Identification and Quantitation

5.1 Data Completeness

All analyses were performed as requested on the COC.

5.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

5.3 Calibrations

5.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

5.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits.

5.3.3 CRDL (Detection Limit) Standard

The CRDL standards were within the control limits.

5.3.4 ICSA/ICSAB (Interference Check) Standards

The ICSA/ICSAB standards met all acceptance criteria.

5.4 Blanks

5.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria with the following exceptions; chromium, copper and lead were detected in the water preparation blank at estimated concentrations less than the RL, but greater than the instrument detection limits (IDL). Therefore, the concentrations of chromium, copper and lead detected in the associated sample at concentrations less than the RL, but greater than the IDL are U qualified as not detected at the RL.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-SW-LV205-071030	Chromium	0.589 B	3.0 U
	Lead	0.279 B	1.0 U
OU1-SW-LV201-071029	Chromium	1.1 B	3.0 U
	Copper	2.5 B	5.0 U
	Lead	0.352 B	1.0 U
OU1-SW-LV406-071029	Chromium	1.2 B	3.0 U
	Copper	2.5 B	5.0 U
	Lead	0.358 B	1.0 U
OU1-SW-LVR203-071030	Chromium	1.4 B	3.0 U
	Copper	2.8 B	5.0 U
	Lead	0.392 B	1.0 U
OU1-SW-LVR211-071031	Copper	3.8 B	5.0 U
OU1-SW-LVR209-071031	Chromium	3.0 B	3.0 U
	Copper	2.2 B	5.0 U
	Lead	0.768 B	1.0 U
OU1-SW-LVR213-071031	Chromium	1.5 B	3.0 U
	Copper	1.6 B	5.0 U

	Lead	0.252 B	1.0 U
OU1-SW-LVR214-071031	Chromium	2.4 B	3.0 U
	Copper	1.6 B	5.0 U
	Lead	0.353 B	1.0 U
OU1-SW-MW401A	Chromium	1.4 B	3.0 U
	Lead	0.816 B	1.0 U
OU1-SW-MW401B	Chromium	1.6 B	3.0 U
	Lead	0.808 B	1.0 U
OU1-SW-MW401C	Chromium	1.3 B	3.0 U
	Lead	0.854 B	1.0 U
OU1-SW-MW401D	Chromium	1.0 B	3.0 U
	Lead	0.799 B	1.0 U

Aluminum, calcium, chromium, iron, lead, manganese and sodium were detected in the soil preparation blank at estimated concentrations less than the RL, but greater than the IDL. Based on the sample concentrations greater than the RL and professional judgment, no sample qualifications were made to the aluminum, calcium, chromium, iron, lead and manganese sample results. However, based on the soil blank concentration of sodium, the sodium concentrations detected in the associated samples are U qualified as not detected at the RL; the concentration of sodium in sample OU1-SS-LVR406-071029 is U qualified as not detected at an elevated detection limit.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-LVR203-071030	Sodium	106 B	500 U
OU1-SS-LVR206-071030	Sodium	86.9 B	500 U
OU1-SS-LVR207-071030	Sodium	123 B	500 U
OU1-SS-LVR208-071030	Sodium	174 B	500 U
OU1-SS-LVR204-071030	Sodium	312 B	500 U
OU1-SS-LVR202-071030	Sodium	121 B	500 U
OU1-SS-LVR201-071029	Sodium	209 B	500 U
OU1-SS-LVR406-071029	Sodium	614 B	614 U
OU1-SS-LVR205-071030	Sodium	221 B	500 U
OU1-SS-LVR214-071031	Sodium	155 B	500 U
OU1-SS-LVR209-071031	Sodium	156 B	500 U
OU1-SS-LVR211-071031	Sodium	195 B	500 U
OU1-SS-LVR212-071031	Sodium	120 B	500 U
OU1-SS-LVR210-071031	Sodium	129 B	500 U
OU1-SS-LVR213-071031	Sodium	146 B	500 U
OU1-SE-UL215-071101	Sodium	242 B	500 U

5.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria with a few exceptions; several ICBs and CCBs had metal detections at estimated concentrations less than the RL, but greater than the IDLs. However, based on professional judgment and

since the metals concentrations for all metals in the waters and soils in the associated samples were either greater than the RL or not detected, no additional sample qualifications were made.

5.4.3 Field QC Samples

Samples OU1-SW-MW-401A, OU1-SW-MW-401B, OU1-SW-MW-401C and OU1-SW-MW-401D are the equipment blanks. The following compounds were detected in the equipment blanks at estimated concentrations less than the RL, but greater than the IDL.

OU1-SW-MW-401A – barium, calcium, chromium, lead, mercury, nickel, potassium, sodium and zinc.

OU1-SW-MW-401B – barium, calcium, chromium, lead, mercury, nickel and zinc.

OU1-SW-MW-401C – barium, calcium, chromium, copper, lead, manganese, mercury, nickel, potassium, sodium, vanadium and zinc.

OU1-SW-MW-401D – barium, calcium, chromium, lead, mercury, nickel, potassium, vanadium and zinc.

Copper was detected in the all the equipment blanks at concentrations greater than the RL.

Based on the concentrations of all of the above metals in the water samples, the following sample qualifications are made. If the sample concentration is estimated less than the RL, the sample is U qualified as undetected at the RL. If the sample concentration is above the RL, the sample is U qualified as undetected at an elevated RL.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-SW-LV205-071030	Copper	1.5 B	5.0 U
	Vanadium	1.1	1.1 U
	Zinc	22.9	22.9 U
OU1-SW-LVR209-071031	Vanadium	1.7	1.7 U
	Zinc	9.8 B	20.0 U
OU1-SW-LVR213-071031	Zinc	4.7 B	20.0 U
OU1-SW-LVR214-071031	Mercury	0.015 B	0.200 U
	Vanadium	0.475 B	1.0 U
	Zinc	4.9 B	20.0 U

Based on professional judgment, no sample qualifications were made to the soil samples, since the concentrations of the metals in the soil samples were at least two times higher than the equipment blank concentrations.

5.5 Laboratory Control Samples (LCS)

All percent recoveries in the soil and water LCS were within the acceptance limits.

5.6 Matrix Spike (MS)

Sample OU1-SW-LVR-205-071030 was analyzed as the water MS; all compound recoveries were within the laboratory control limits.

Sample OU1-SS-LVR205-071030 was analyzed as the soil MS. The following compounds were outside of the laboratory control limits: Aluminum, barium, cadmium, calcium, copper, iron, lead, manganese, vanadium and zinc. However, since the concentration of these metals in the unspiked sample exceeded the spike concentration by a factor of four or greater, the spike recovery control limits do not apply and qualification of the data is not required. The recoveries for antimony and selenium were low and outside of the laboratory control limits; the recovery for cobalt was high and outside of the laboratory control limits. Therefore, the concentration in sample OU1-SS-LVR205-071030 of antimony is UJ qualified as estimated less than the RL, the concentration of selenium is J- qualified as estimated with a low bias, and the concentration of cobalt in sample OU1-SS-LVR205-071030 are J+ qualified as estimated with a high bias.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-LVR205-071030	Antimony	0.981 U	0.981 UJ
	Cobalt	3.5	3.5 J+
	Selenium	0.524 B	0.524 J-

5.7 Laboratory Duplicate Samples

Sample OU1-SW-LVR205-071030 was analyzed as the water laboratory duplicate. All RPD results were acceptable, with the exception of arsenic, chromium, thallium and vanadium. However, since arsenic, chromium, thallium and vanadium were detected at a estimated concentration less than the RL but greater than the IDL in the duplicate, no sample qualifications were required.

Sample OU1-SS-LVR205-071030 was analyzed as the soil laboratory duplicate. Cadmium was outside of the laboratory acceptance limits for RPD. Therefore, the concentration of cadmium in sample OU1-SS-LVR205-071030 is J qualified as estimated.

Sample ID	Compound	Laboratory Result (mg/kg)	Validation Result (mg/kg)
OU1-SS-LVR205-071030	Cadmium	1.1 B	1.1 J

5.8 Serial Dilutions

The percent differences for the compounds for the serial dilution for the total metals water analysis of sample OU1-SW-LVR205-071030 were outside of the laboratory acceptance criteria for chromium, potassium, selenium, thallium and vanadium;

however, these metals concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required.

The percent differences for the compounds for the serial dilution for the total metals soil analysis of sample OU1-SS-LVR205-071030 were outside of the laboratory acceptance criteria for beryllium, chromium, selenium and silver; however, the beryllium, chromium, selenium and silver concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required.

5.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

The concentrations of some compounds in the samples were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the IDL. These concentrations are J qualified as estimated.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-SW-LV205-071030	Cobalt	0.421 B	0.421 J
	Selenium	0.659 B	0.659 J
	Thallium	0.064 B	0.064 J
OU1-SW-LV201-071029	Arsenic	0.341 B	0.341 J
	Selenium	0.843 B	0.843 J
OU1-SW-LV406-071029	Arsenic	0.313 B	0.313 J
	Selenium	0.915 B	0.915 J
OU1-SW-LVR203-071030	Arsenic	0.423 B	0.423 J
	Selenium	0.991 B	0.991 J
OU1-SW-LVR211-071031	Beryllium	0.119 B	0.119 J
	Cadmium	0.477 B	0.477 J
	Thallium	0.043 B	0.043 J
OU1-SW-LVR209-071031	Arsenic	0.879 B	0.879 J
	Cobalt	0.878 B	0.878 J
	Zinc	9.8 B	9.8 J
OU1-SW-LVR213-071031	Arsenic	0.475 B	0.475 J
	Cobalt	0.493 B	0.493 J
	Selenium	0.782 B	0.782 J
	Zinc	4.7 B	4.7 J

OU1-SW-LVR214-071031	Arsenic	0.528 B	0.528 J
	Cobalt	0.643 B	0.643 J
	Vanadium	0.475 B	0.475 J
	Zinc	4.9 B	4.9 J
OU1-SW-MW401A	Barium	0.514 B	0.514 J
	Calcium	126 B	126 J
	Mercury	0.015 B	0.015 J
	Nickel	0.137 B	0.137 J
	Potassium	144 B	144 J
	Sodium	54.0 B	54.0 J
	Zinc	18.2 B	18.2 J
OU1-SW-MW401B	Barium	0.394 B	0.394 J
	Calcium	92.6 B	92.6 J
	Mercury	0.017 B	0.017 J
	Nickel	0.352 B	0.352 J
	Zinc	16.0 B	16.0 J
OU1-SW-MW401C	Barium	0.641 B	0.641 J
	Calcium	156 B	156 J
	Manganese	2.7 B	2.7 J
	Mercury	0.028 B	0.028 J
	Nickel	0.187 B	0.187 J
	Potassium	178 B	178 J
	Sodium	159 B	159 J
	Vanadium	0.525 B	0.525 J
OU1-SW-MW401D	Barium	0.404 B	0.404 J
	Calcium	101 B	101 J
	Mercury	0.016 B	0.016 J
	Nickel	0.186 B	0.186 J
	Potassium	107 B	107 J
	Vanadium	1.1 B	1.1 J
	Zinc	13.8 B	13.8 J

Sample	Metal	Laboratory Concentration (mg/kg)	Validation Concentration (mg/kg)
OU1-SS-LVR203-071030	Antimony	2.0 B	2.0 J
	Beryllium	0.139 B	0.139 J
	Mercury	0.022 B	0.022 J
	Silver	0.755 B	0.755 J
OU1-SS-LVR206-071030	Beryllium	0.231 B	0.231 J
	Cadmium	1.1 B	1.1 J
	Mercury	0.011 B	0.011 J
	Selenium	0.524 B	0.524 J

	Silver	0.387 B	0.387 J
	Thallium	0.057 B	0.057 J

OU1-SS-LVR207-071030	Beryllium	0.285 B	0.285 J
	Copper	5.9 B	5.9 J
	Mercury	0.012 B	0.012 J
	Selenium	0.515 B	0.515 J
	Silver	0.247 B	0.247 J
OU1-SS-LVR208-071030	Beryllium	0.355 B	0.355 J
	Cadmium	0.757 B	0.757 J
	Copper	6.5 B	6.5 J
	Mercury	0.007 B	0.007 J
	Selenium	0.541 B	0.541 J
OU1-SS-LVR204-071030	Silver	0.880 B	0.880 J
	Beryllium	0.423 B	0.423 J
	Mercury	0.041 B	0.041 J
OU1-SS-LVR202-071030	Selenium	0.977 B	0.977 J
	Beryllium	0.152 B	0.152 J
	Mercury	0.014 B	0.014 J
	Selenium	0.379 B	0.379 J
OU1-SS-LVR201-071029	Silver	0.614 B	0.614 J
	Beryllium	0.449 B	0.449 J
	Mercury	0.006 B	0.006 J
	Selenium	0.911 B	0.911 J
OU1-SS-LVR406-071029	Thallium	0.080 B	0.080 J
	Beryllium	0.511 B	0.511 J
	Mercury	0.010 B	0.010 J
OU1-SS-LVR205-071030	Thallium	0.230 B	0.230 J
	Beryllium	0.848 B	0.848 J
	Selenium	1.2 B	1.2 J
	Silver	0.760 B	0.760 J
OU1-SS-LVR214-071031	Thallium	0.343 B	0.343 J
	Beryllium	0.340 B	0.340 J
	Mercury	0.006 B	0.006 J
	Selenium	0.668 B	0.668 J
	Silver	0.571 B	0.571 J
OU1-SS-LVR209-071031	Thallium	0.118 B	0.118 J
	Beryllium	0.356 B	0.356 J
	Selenium	0.490 B	0.490 J
	Silver	0.345 B	0.345 J
OU1-SS-LVR211-071031	Thallium	0.085 B	0.085 J
	Beryllium	0.616 B	0.616 J
	Mercury	0.033 B	0.033 J
	Selenium	0.658 B	0.658 J
	Silver	0.409 B	0.409 J
	Thallium	0.161 B	0.161 J

OU1-SS-LVR212-071031	Beryllium	0.256 B	0.256 J
	Cadmium	0.986 B	0.986 J
	Mercury	0.009 B	0.009 J
	Selenium	0.506 B	0.506 J
	Silver	0.383 B	0.383 J
	Thallium	0.061 B	0.061 J
OU1-SS-LVR210-071031	Beryllium	0.221 B	0.221 J
	Chromium	4.9 B	4.9 J
	Mercury	0.008 B	0.008 J
	Selenium	0.712 B	0.712 J
	Silver	0.224 B	0.224 J
OU1-SS-LVR213-071031	Beryllium	0.393 B	0.393 J
	Cadmium	1.1 B	1.1 J
	Mercury	0.027 B	0.027 J
	Silver	0.239 B	0.239 J
	Thallium	0.134 B	0.134 J
OU1-SE-UL215-071101	Antimony	4.8 B	4.8 J
	Beryllium	0.993 B	0.993 J
	Thallium	0.615 B	0.615 J

6.0 Cyanide (EPA Method 9012) and Percent Solids (Modified Method 160.3)

The soil and water samples were analyzed for cyanide (EPA Method 9012) and percent solids (EPA Modified Method 160.3). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review. In addition, the percent solids data was reviewed and found to be acceptable.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ Laboratory Control Sample
- ✓ Matrix Spike Sample
- ✓ Laboratory Duplicate Sample

7.1 Data Completeness

All analyses were performed as requested on the COC.

7.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

7.3 Calibrations

7.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for Cyanide analysis.

7.3.2 Continuing Calibration Verification (CCV)

The percent recoveries in all associated CCVs were within the QC acceptance limits for Cyanide.

7.4 Blanks

7.4.1 Preparation (Method) Blank

The preparation blank met the acceptance criteria; Cyanide was not detected in the method blank.

7.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICB and CCBs met the acceptance criteria; no Cyanide was detected in either the ICB or CCBs.

7.5 Laboratory Control Sample (LCS)

The cyanide percent recoveries in the LCSs (water and soil) were within the acceptance limits.

7.6 Matrix Spike (MS)

Sample OU1-SW-LVR205-071030 was analyzed as the water MS; the cyanide recovery was within the laboratory control limits.

Sample OU1-SS-LVR205-071030 was analyzed as the soil MS; the cyanide recovery was within the laboratory control limits.

7.7 Laboratory Duplicate Samples

Sample OU1-SW-LV205-071030 was analyzed as the water laboratory duplicate; cyanide was not detected in either the original or lab duplicate.

Sample OU1-SS-LVR205-071030 was analyzed as the soil laboratory duplicate; cyanide was not detected in either the original or lab duplicate.

ATTACHMENT A
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by GeoSyntec's Data Review Team

DATA QUALIFIER DEFINITIONS

- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Memorandum

TO: Nandra Weeks
DATE: March 6, 2008
FROM: Geosyntec Consultants QA/QC Group
SITE: Mattheissen and Hegeler Zinc Company Site, OU1
SUBJECT: Summary of Tier III Validation of analytical results for CAS Report R2740633

Introduction

This report summarizes the findings of the full validation of 5 soil samples collected on behalf of the Mattheissen and Hegeler Zinc Company Site, OU1 project. These samples were collected on October 29-30, 2007. The samples were analyzed by Columbia Analytical Services, Inc. (CAS), Rochester, New York. The samples were analyzed for a client specified list of Acid Volatile Sulfide/Simultaneously Extracted Metals (AVS/SEM) by EPA *Draft Analytical Method for Determination of Acid Volatile Sulfide in Sediment*, December 1991, EPA Method 6010B and EPA Method 376.1.

The data were reviewed in accordance with the principles presented in *USEPA National Functional Guidelines for Laboratory Data Review, Inorganics* (EPA, 2004), and per the requirements of the QAPP, the laboratory standard operating procedures and the specified methods.

Data for the following samples were reviewed.

Field Sample ID	CAS Job Number
OU1-SS-LVR203-071030	1050477
OU1-SS-LVR207-071030	1050478
OU1-SS-LVR201-071029	1050479
OU1-SS-LVR406-071029	1050480
OU1-SS-LVR205-071030	10504816

Matrix – soil

Executive Summary

All analyses were performed as requested on the chain of custody (COC).

All holding times were met.

1.0 Metals (EPA Methods 6010B)

The soil samples were analyzed for the specified list of metals (cadmium, copper, lead, nickel and zinc) following simultaneous extraction (EPA *Draft Analytical Method for Determination of Acid Volatile Sulfide in Sediment*, December 1991 and EPA Method 6010B). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPS and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ Laboratory Control Samples
- ✓ Matrix Spike/Matrix Spike Duplicate Samples
- ✓ Laboratory Duplicate Samples
- ✓ Serial Dilutions
- ✓ Compound Identification and Quantitation

1.1 Data Completeness

All analyses were performed as requested on the COC. There are two samples on the COC with the same ID, OU1-SS-LVR206-0071030. One was collected 10/30/07, 1535 and given lab ID 1050447. The one collected 10/30/07, 1500 was given the lab ID 10540478. This second one was identified in the lab report as OUI-SS-LVR207-071030, based on email communication between CAS and the client.

1.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

1.3 Calibrations

1.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

1.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits.

1.3.3 CRDL (Detection Limit) Standard

The CRDL standards were within the control limits.

1.3.4 ICSA/ICSAB (Interference Check) Standards

The ICSA/ICSAB standards met all acceptance criteria.

1.4 Blanks

1.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria.

1.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria.

1.5 Laboratory Control Samples (LCS)

All percent recoveries in the LCS were within the acceptance limits.

1.6 Matrix Spike (MS)

Sample OU1-SSW-LVR05-071030 was analyzed as the MS; all compound recoveries were within the laboratory control limits, with the exception of cadmium, lead and zinc. However, since the sample concentrations for these compounds were greater than four times the spike concentrations, no sample qualifications were required.

1.7 Laboratory Duplicate Samples

Sample OU1-SSW-LVR05-071030 was analyzed as the laboratory duplicate. All relative percent difference (RPD) results were acceptable.

1.8 Serial Dilutions

The percent differences for the compounds for the serial dilution of sample OU1-SSW-LVR05-071030 were outside of the laboratory acceptance criteria for copper and nickel; however, these metals concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required.

1.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

2.0 Acid Volatile Sulfide (AVS)-EPA Draft Analytical Method for Determination of Acid Volatile Sulfide in Sediment, December 1991 and EPA Method 376.1

The soil samples were analyzed for AVS. Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review. In addition, the percent solids data was reviewed and found to be acceptable.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ Laboratory Control Sample
- ✓ Matrix Spike Sample
- ✓ Laboratory Duplicate Sample

2.1 Data Completeness

All analyses were performed as requested on the COC.

2.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

2.3 Calibrations

2.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for sulfide analysis.

2.3.2 Continuing Calibration Verification (CCV)

The percent recoveries in the associated CCVs were within the QC acceptance limits.

2.4 Blanks

2.4.1 Preparation (Method) Blank

The preparation blank met the acceptance criteria; sulfide was not detected in the method blank.

2.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICB and CCBs met the acceptance criteria; no sulfide was detected in either the ICB or CCBs.

2.5 Laboratory Control Sample (LCS)

The sulfide percent recovery in the LCS was within the acceptance limits.

2.6 Matrix Spike (MS)

Sample OU1-SSW-LVR05-071030 was analyzed as the MS; the sulfide recovery was within the laboratory control limits.

2.7 Laboratory Duplicate Samples

Sample OU1-SSW-LVR05-071030 was analyzed as the laboratory duplicate. The RPD result was acceptable.

ATTACHMENT A
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by GeoSyntec's Data Review Team

DATA QUALIFIER DEFINITIONS

- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Memorandum

TO: Nandra Weeks
DATE: March 10, 2008
FROM: Geosyntec Consultants QA/QC Group
SITE: Mattheissen and Hegeler Zinc Company Site, OU1
SUBJECT: Summary of Tier III Validation of analytical results for CAS Report R2740697

Introduction

This report summarizes the findings of the full validation of one surface water sample, collected on behalf of the Mattheissen and Hegeler Zinc Company Site, OU1 project. The sample was collected on October 30, 2007. The sample was analyzed by Columbia Analytical Services, Inc. (CAS), Rochester, New York. The sample was analyzed for Organochlorine Pesticides by EPA Method 8081A, Total Metals by EPA Methods 6020 and 6010B and Mercury by EPA Method 7470A.

The data were reviewed in accordance with the principles presented in *USEPA National Functional Guidelines for Laboratory Data Review, Organics* (EPA, 2005), *USEPA National Functional Guidelines for Laboratory Data Review, Inorganics* (EPA, 2004), and per the requirements of the QAPP, the laboratory standard operating procedures and the specified methods.

Data for the following sample was reviewed.

Field Sample ID	CAS Job Number
OU1-SW-LVR207-071030	1052143

Matrix – surface water

Executive Summary

All analyses were performed as requested on the chain of custody (COC).

All holding times were met.

1.0 Organochlorine Pesticides (EPA Method 8081A)

Full validation including recalculation was performed on the laboratory data for the analysis of Organochlorine Pesticides (EPA Method 8081A). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ⊗ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ✓ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

1.1 Data Completeness

All analyses were performed as requested on the COC.

1.2 Holding Times and Preservation

The sample for organochlorine pesticide analysis was extracted one day outside of the 7 day technical holding time from date of collection; the sample extract was analyzed within the 40 day technical holding time from date of extraction. Based on professional judgment, no sample qualifications were made.

1.3 Calibrations

1.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the average response factors (RFs). For all target analytes, the RSDs met the method criteria for all compounds.

1.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the percent differences (%D) between the average RFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

1.4 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

1.5 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

1.6 Laboratory Control Samples (LCS)

All LCS/LCS duplicate (LCSD) recoveries and RPDs were within the laboratory control limits.

1.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

A MS/MSD pair was not analyzed.

1.8 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

2.0 Metals (EPA Methods 6020/6010B/7470A)

The water sample was analyzed for the requested metals and Mercury (EPA 6020/6010B/7470A) following total metals digestion and Mercury digestion. Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPS and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ⊗ Blanks
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ⊗ Laboratory Duplicate Samples
- ⊗ Serial Dilutions
- ⊗ Compound Identification and Quantitation

2.1 Data Completeness

All analyses were performed as requested on the COC.

2.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

2.3 Calibrations

2.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

2.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits, with the following exception. The recovery of mercury in the closing CCV was high and outside of the acceptance limits. However, based on professional judgment and the qualification of the sample's mercury result due to the continuing calibration blank (CCB, below), no additional sample qualification was made.

2.3.3 CRDL (Detection Limit) Standard

The CRDL standards were within the control limits.

2.3.4 ICSA/ICSAB (Interference Check) Standards

The ICSA/ICSAB standards met all acceptance criteria.

2.4 Blanks

2.4.1 Preparation (Method) Blank

The preparation blank met the acceptance criteria with the following exceptions; chromium, copper, and lead were detected in the preparation blank at estimated concentrations less than the reporting limit (RL), but greater than the instrument detection limits (IDL). Since the chromium and lead concentrations in the sample were higher than the RL, no sample qualifications were required; however, the concentration of copper detected in the associated sample at an estimated concentration less than the RL but greater than the IDL is U qualified as not detected at the RL.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-SW-LVR207-071030	Copper	2.6 B	5.0 U

2.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria with the following exceptions; several ICBs and CCBs had metal detections at estimated concentrations less than the RL, but greater than the IDL. However, based on professional judgment and since the concentrations for all metals except mercury in the associated sample were either greater than the RL or not detected, no additional sample qualifications were made. Based on the mercury concentrations reported in the CCBs and the estimated concentration in the sample less than

the RL but greater than the IDL, the concentration of mercury in the associated sample is U qualified as not detected at the RL.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-SW-LVR207-071030	Mercury	0.18 B	0.20 U

2.5 Laboratory Control Samples (LCS)

All percent recoveries in the LCS were within the acceptance limits.

2.6 Matrix Spike (MS)

Sample OU1-SW-LVR207-071030 was analyzed as the MS; all compound recoveries were within the laboratory control limits.

The metals analyzed by EPA Method 6010B were spiked into a batch QC sample. No information was provided on the batch QC sample results.

2.7 Laboratory Duplicate Samples

Sample OU1-SW-LVR207-071030 was analyzed as the laboratory duplicate. All RPD results were acceptable, with the exception of arsenic, selenium and vanadium. However, since arsenic, selenium and vanadium were detected at concentrations less than the RL, but greater than the IDL, no sample qualifications were required.

The metals analyzed by EPA Method 6010B were assessed using a batch QC sample. No information was provided on the batch QC sample results.

2.8 Serial Dilutions

The percent differences for the compounds for the serial dilution for the total metals water analysis of sample OU1-SW-LV205-071030 were outside of the laboratory acceptance criteria for arsenic, chromium, cobalt, nickel, potassium, selenium, vanadium and zinc; however, all these metals except potassium had concentrations in the serial dilution less than 50 times the IDL and no sample qualifications are required. Therefore, the concentration of potassium in sample OU1-SW-LV205-071030 is J qualified as estimated since it is greater than 50 times the IDL.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-SW-LVR207-071030	Potassium	5100	5100 J

3.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

The concentrations of some compounds in the sample were B qualified by the laboratory, indicating an estimated sample concentration less than the reporting limit,

but greater than the instrument detection limit. These concentrations are J qualified as estimated.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-SW-LV205-071030	Arsenic	0.429 B	0.429 J
	Copper	2.6 B	2.6 J
	Selenium	0.679 B	0.679 J
	Zinc	8.4 B	8.4 J

ATTACHMENT A
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by GeoSyntec's Data Review Team

DATA QUALIFIER DEFINITIONS

- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Memorandum

TO: Nandra Weeks

DATE: March 11, 2008

FROM: Geosyntec Consultants QA/QC Group

SITE: Mattheissen and Hegeler Zinc Company Site, OU1

SUBJECT: Summary of Tier III Validation of analytical results for CAS Report R2741179

Introduction

This report summarizes the findings of the full validation of 4 groundwater samples and one trip blank collected on behalf of the Mattheissen and Hegeler Zinc Company Site, OU1 project. These samples were collected on December 3-4, 2007. The samples were analyzed by Columbia Analytical Services, Inc. (CAS), Rochester, New York. The samples were analyzed for Volatile Organic Compounds by EPA Method 8260B, Semivolatile Organic Compounds by EPA Method 8270C, Total and Dissolved metals by EPA Methods 6020 and 6010B, Total and Dissolved Mercury by EPA Method 7470A, Total Organic Carbon (TOC) by EPA Method 415.1, Cyanide by EPA Method 9012A, Sulfate by EPA Method 300.0 and ortho-Phosphate by EPA Method 365.1.

The data were reviewed in accordance with the principles presented in *USEPA National Functional Guidelines for Laboratory Data Review, Organics* (EPA, 2005), *USEPA National Functional Guidelines for Laboratory Data Review, Inorganics* (EPA, 2004), and per the requirements of the QAPP, the laboratory standard operating procedures and the specified methods.

Data for the following samples were reviewed.

Lab ID	Client ID
1059800	OUI-GW-G-103-0712
1059802	OUI-GW-G-106-0712
1059807	OUI-GW-MW-303H-0712
1059808	OUI-GW-MW-305H-0712
1059809	OUI-GW-MW-402-0712
1059810	SOLUBLE OU1-GW-G-106-0712
1059811	SOLUBLE OU1-GW-MW-303H-0

1059812	SOLUBLE OU1-GW-MW-305H-0
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Matrix – groundwater and 1 aqueous trip blank

Executive Summary

All analyses were performed as requested on the chain of custody (COC), except as noted below.

The methods listed on the COC for TOC analysis and ortho-phosphate analysis were EPA Method 9060 and EPA Method 300.0/9056, respectively. The methods used by the laboratory for analysis were EPA Method 415.1 for TOC and EPA Method 365.1 for ortho-phosphate.

The collection dates for the samples were not listed on the COC. The laboratory used collection dates of December 3-4, 2007.

Incorrect error correction was observed on the COC instead of the proper procedure of a single strike through, correction, and initials and date of person making the correction.

All holding times were met.

1.0 Volatile Organic Compounds (EPA Method 8260B)

Full validation including recalculation was performed with the laboratory data for the analysis of volatile organic compounds (EPA Method 8260B). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ⊗ Calibrations
- ✓ Internal Standards
- ✓ Performance Check Sample
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Matrix Spike/Matrix Spike Duplicate Sample
- ✓ Laboratory Control Samples
- ✓ Compound Identification and Quantitation

1.1 Data Completeness

All analyses were performed as requested on the COC.

1.2 Holding Times and Preservation

All samples were analyzed within the 14 day technical holding time from date of collection for volatiles.

1.3 Calibrations

1.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the percent relative standard deviation (%RSD) of the relative response factors (RRFs). For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

1.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method or validation acceptance criteria, with the following exception. Methylcyclohexane in the CCV was outside of the acceptance limits. Therefore, the undetected concentrations of methylcyclohexane in the associated samples are UJ qualified as estimated below the reporting limit (RL).

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OUI-GW-G-103-0712	Methylcyclohexane	1.0 U	1.0 UJ
OUI-GW-G-106-0712	Methylcyclohexane	1.0 U	1.0 UJ
OUI-GW-MW-402-0712	Methylcyclohexane	1.0 U	1.0 UJ

1.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts.

1.5 Performance Check Samples

An instrument performance check sample (tune standard) was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for bromofluorobenzene (BFB).

1.6 Blanks

There were no detections of the project compounds of concern in laboratory method blanks.

Sample OUI-GW-MW-402-0712 was submitted as the trip blank. Acetone was detected in the trip blank at an estimated concentration greater than the method detection limit (MDL), but less than the RL. However, since acetone was not detected in the associated samples, no sample qualifications were made.

1.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

1.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits.

1.9 Matrix Spike/Matrix Spike Duplicate Sample (MS/MSD)

A MS/MSD pair was not analyzed.

1.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

2.0 Semivolatile Organic Compounds (EPA Method 8270C)

Full validation including recalculation was performed on the laboratory data for the analysis of semivolatile organic compounds (EPA Method 8270C). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ⊗ Calibrations
- ✓ Internal Standards
- ⊗ Performance Check Sample
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Laboratory Control Samples
- ✓ Matrix Spike/Matrix Spike Duplicate
- ⊗ Compound Identification and Quantitation

2.1 Data Completeness

All analyses were performed as requested on the COC.

2.2 Holding Times and Preservation

The samples for semivolatile analysis were extracted within the 7 day technical holding time from date of collection and analyzed within the 40 day technical holding time from date of extraction.

2.3 Calibrations

2.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the RRFs. For all target analytes, the RRFs met the method criteria; the RSDs met the method or

validation criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations. It was noted that linear curve fits using only 5 points were used for 2,4-dinitrophenol and pentachlorophenol; Method 8000 requires the use of a minimum of 6 points for linear curve fits. However, based on professional judgment, no sample qualifications were made.

2.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method or validation acceptance criteria.

2.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts.

2.5 Performance Check Samples

An instrument performance check sample was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for decafluorotriphenylphosphine (DFTPP). It was noted that on all 5B Forms, the percent relative abundances for mass 441 compared to mass 443 were wrong. However, the raw data confirmed that mass 441 passed the method criteria; therefore, no sample qualifications were required. The laboratory was notified of the error.

2.6 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

2.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

2.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits, with the exception of benzaldehyde, which had high recoveries, outside of the laboratory control limits, in the LCS and LCSD. However, since benzaldehyde was not detected in any of the samples, no sample qualifications were required.

2.9 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

A MS/MSD pair was not analyzed.

2.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

3.0 Metals (EPA Methods 6020/6010B/7470A)

The water samples were analyzed for the requested total and dissolved metals and Mercury (EPA 6020/6010B/7470A) following metals digestion and mercury digestion. Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ⊗ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ⊗ Laboratory Duplicate Samples
- ⊗ Serial Dilutions
- ✓ Compound Identification and Quantitation

3.1 Data Completeness

All analyses were performed as requested on the COC. It was noted that the sample results were not reported down to the instrument detection limit (IDL), i.e., the sample and QC sample results between the IDL and the RL were not reported. Corrected forms with sample results reported to the IDL were requested from the laboratory and were sent by email.

In addition, the serial dilution form included in the data package was incomplete. A revised serial dilution form was requested from the laboratory and was sent by email. The initial and serial dilution results for barium, cobalt and nickel listed on the revised form did not agree with the raw data. Another revised serial dilution form was requested from the laboratory and was sent by email.

3.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

3.3 Calibrations

3.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

3.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits.

3.3.3 CRDL (Detection Limit) Standard

The CRDL standards were within the control limits.

3.3.4 ICSA/ICSAB (Interference Check) Standards

The ICSA/ICSAB standards met all acceptance criteria.

3.4 Blanks

3.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria with the following exceptions; antimony, chromium, copper and zinc were detected in the water preparation blank at estimated concentrations less than the RL, but greater than the IDL. Antimony was not detected in any sample; therefore, no antimony sample concentrations are qualified. However, the estimated concentrations of chromium, copper, and zinc detected in the associated samples at estimated concentrations less than the RL, but greater than the IDL are U qualified as not detected at the RL.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OUI-GW-G-103-0712	Chromium	1.4 B	15 U
	Copper	3.6 B	5.0 U
OUI-GW-G-106-0712	Chromium	1.3 B	15 U
	Copper	5.0 B	5.0 U
	Dissolved Chromium	1.6 B	15 U
OUI-GW-MW-303H-0712	Chromium	1.5 B	15 U
	Copper	2.5 B	5.0 U
	Zinc	11.2 B	20 U
	Dissolved Chromium	2.2 B	15 U
	Dissolved Copper	2.7 B	5.0 U
	Dissolved Zinc	11.4 B	20 U
OUI-GW-MW-305H-0712	Chromium	1.4 B	15 U
	Copper	1.9 B	5.0 U
	Dissolved Chromium	3.2 B	15 U
	Dissolved Copper	2.7 B	5.0 U

3.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria with a few exceptions; several ICBs and CCBs had metal detections at estimated concentrations less than the

RL, but greater than the IDLs. However, based on professional judgment and since the metals concentrations for all metals in the associated samples were either greater than the RL or not detected, no additional sample qualifications were made.

3.5 Laboratory Control Samples (LCS)

All percent recoveries in the LCS were within the acceptance limits.

3.6 Matrix Spike (MS)

Sample OU1-GW-G-103-0712 was analyzed as the MS; only mercury was spiked into the MS. The recovery of mercury was within the laboratory control limits.

The metals analyzed by EPA Method 6010B and 6020 were assessed using a batch QC sample. No information was provided on the batch QC sample results.

3.7 Laboratory Duplicate Samples

Sample OU1-GW-G-103-0712 was analyzed as the laboratory duplicate; only mercury was assessed. The RPD result was acceptable.

The metals analyzed by EPA Method 6010B and 6020 were assessed using a batch QC sample. No information was provided on the batch QC sample results.

3.8 Serial Dilutions

The percent differences for the compounds for the serial dilution for the dissolved metals analysis of sample OU1-GW-MW-305-H-00712 were outside of the laboratory acceptance criteria for aluminum, cobalt and nickel; however, these metals concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required.

3.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

Three samples were analyzed for both total and dissolved metals. All three samples had some total metals concentrations less than the dissolved metals concentrations. In each of these three samples, the difference between the total and dissolved metals concentrations were less than 10% for most metals; however, for samples with percent difference greater than 10%, the total and dissolved metals concentrations are UJ qualified as estimated less than the RL or J qualified as estimated. The following table summarizes the percent differences between the total and dissolved iron concentrations and the appropriate qualifications for these three samples.

Sample	Metal	Total Concentration (ug/L)	Dissolved Concentration (ug/L)	Percent Difference (%)	Total Validation Result (ug/L)	Dissolved Validation Result (ug/L)
OUI-GW-G-	Calcium	663000	715000	8	NA	NA
	Chromium	1.3 B	1.6 B	NC	NA	NA

106-0712	Copper	5.0 B	5.6	NC	NA	NA
	Iron	889	947	6	NA	NA
	Lead	1.1B	1.2 B	NC	NA	NA
	Magnesium	72000	75400	5	NA	NA
	Manganese	1890	1960	4	NA	NA
	Nickel	62.3	63.0	1	NA	NA
	Potassium	86700	89300	3	NA	NA
	Selenium	2.3 B	1.1 B	NC	NA	NA
	Sodium	362000	372000	3	NA	NA
	Zinc	14300	15300	7	NA	NA
OUI-GW-MW-303H-0712	Aluminum	17.1 U	95.9 B	NC	NA	NA
	Barium	53.5	54.3	1	NA	NA
	Calcium	422000	435000	3	NA	NA
	Chromium	1.5 B	2.2 B	NC	NA	NA
	Cobalt	3.1 B	3.2 B	NC	NA	NA
	Copper	2.5 B	2.7 B	NC	NA	NA
	Iron	1370	1730	23	1370 J	1730 J
	Lead	0.600 U	0.620 B	NC	NA	NA
	Manganese	4000	4020	1	NA	NA
	Potassium	48200	48800	1	NA	NA
	Sodium	209000	218000	4	NA	NA
	Zinc	11.2 B	11.4 B	NC	NA	NA
GW-MW-305H-0712	Aluminum	17.1 U	268	> 200	100 UJ	268 J
	Arsenic	2.5 B	2.6 B	NC	NA	NA
	Barium	30.2	40.6	29	30.2 J	40.6 J
	Calcium	496000	512000	3	NA	NA
	Chromium	1.4 B	3.2 B	NC	NA	NA
	Cobalt	4.9 B	5.5	> 200	5.0 UJ	5.5 J
	Copper	1.9 B	2.7 B	NC	NA	NA
	Iron	2340	3500	40	2340 J	3500 J
	Lead	0.600 U	1.8 B	NC	NA	NA
	Magnesium	149000	155000	4	NA	NA
	Manganese	5220	5450	4	NA	NA
	Nickel	16.2	16.7	3	NA	NA
	Zinc	61.5	97.1	45	61.5 J	97.1 J

NC-not calculable

NA-not applicable

The concentrations of some compounds in the samples were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the IDL. These concentrations are J qualified as estimated.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OUI-GW-G-103-0712	Cadmium	0.619 B	0.619 J
	Cobalt	1.8 B	1.8 J
	Selenium	2.7 B	2.7 J
	Vanadium	1.3 B	1.3 J
OUI-GW-G-106-0712	Arsenic	0.649 B	0.649 J

	Lead	1.1 B	1.1 J
	Selenium	2.3 B	2.3 J
	Dissolved Lead	1.2 B	1.2 J
	Dissolved Selenium	1.1 B	1.1 J
OUI-GW-MW-303H-0712	Arsenic	0.841 B	0.841 J
	Cobalt	3.1 B	3.1 J
	Selenium	1.9 B	1.9 J
	Dissolved Aluminum	95.9 B	95.9 J
	Dissolved Arsenic	0.529 B	0.529 J
	Dissolved Cobalt	3.2 B	3.2 J
	Dissolved Lead	0.620 B	0.620 J
	Dissolved Selenium	1.5 B	1.5 J
GW-MW-305H-0712	Arsenic	2.5 B	2.5 J
	Cobalt	4.9 B	4.9 J
	Selenium	1.9 B	1.9 J
	Dissolved Arsenic	2.6 B	2.6 J
	Dissolved Lead	1.8 B	1.8 J
	Dissolved Selenium	0.997 B	0.997 J

4.0 Cyanide (EPA Method 9012), Total Organic Carbon (EPA Method 415.1), Sulfate (EPA Method 300.0) and ortho-Phosphate (EPA Method 365.1)

The water samples were analyzed for cyanide (EPA Method 9012), total organic carbon (TOC EPA Method 415.1), sulfate (EPA Method 300.0) and ortho-phosphate (EPA Method 365.1). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ⊗ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations

- ✓ Blanks
- ✓ Laboratory Control Sample
- ⊗ Matrix Spike Sample
- ⊗ Laboratory Duplicate Sample

4.1 Data Completeness

All analyses were performed as requested on the COC records, with the following exceptions. The methods listed on the COC for TOC analysis and ortho-phosphate analysis were EPA 9060 and EPA 300.0/9056, respectively. The methods used by the laboratory for analysis were EPA 415.1 for TOC and EPA 365.1 for ortho-phosphate.

4.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times. Method 365.1 states that samples for ortho-phosphate must be preserved with sulfuric acid and analyzed within 28 days of collection. The samples were not preserved with sulfuric acid and were analyzed within 2 days of collection; based on professional judgment, no sample qualifications were made.

4.3 Calibrations

4.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for all analyses.

4.3.2 Continuing Calibration Verification (CCV)

The percent recoveries in all associated CCVs were within the QC acceptance limits for all analyses.

4.4 Blanks

4.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria; no compounds were detected in the method blanks.

4.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICB and CCBs met the acceptance criteria; no compounds were detected in either the ICB or CCBs.

4.5 Laboratory Control Sample (LCS)

The percent recoveries in the LCSs were within the acceptance limits for all analyses.

4.6 Matrix Spike (MS)

A MS was not analyzed. Results of batch QC analyses were not reported.

4.7 Laboratory Duplicate Samples

Laboratory duplicates were not analyzed. Results of batch QC analyses were not reported.

ATTACHMENT A
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by GeoSyntec's Data Review Team

DATA QUALIFIER DEFINITIONS

- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Memorandum

TO: Nandra Weeks

DATE: February 28, 2008

FROM: Geosyntec Consultants QA/QC Group

SITE: Mattheissen and Hegeler Zinc Company Site, OU1

SUBJECT: Summary of Tier III Validation of analytical results for CAS Report R2741246

Introduction

This report summarizes the findings of the full validation of 7 groundwater samples, one trip blank, one field blank and one equipment blank collected on behalf of the Mattheissen and Hegeler Zinc Company Site, OU1 project. These samples were collected on January 14, 15, and 17, 2008. The samples were analyzed by Columbia Analytical Services, Inc. (CAS), Rochester, New York. The samples were analyzed for Volatile Organic Compounds by EPA Method 8260B, Semivolatile Organic Compounds by EPA Method 8270C, Total and Dissolved metals by EPA Methods 6020 and 6010B, Total and Dissolved Mercury by EPA Method 7470A, Total Organic Carbon (TOC) by EPA Method 415.1, Cyanide by EPA Method 9012A, Sulfate by EPA Method 300.0 and ortho-Phosphate by EPA Method 365.1.

The data were reviewed in accordance with the principles presented in *USEPA National Functional Guidelines for Laboratory Data Review, Organics* (EPA, 2005), *USEPA National Functional Guidelines for Laboratory Data Review, Inorganics* (EPA, 2004), and per the requirements of the QAPP, the laboratory standard operating procedures and the specified methods.

Data for the following samples were reviewed.

Lab ID	Client ID
1060748	OU1-GW-G-101-0712
1060749	OU1-GW-G-02-0712
1060754	OU1-GW-MW-A-0712
1060756	OU1-GW-MW404-0712
1060760	OU1-GW-P-7-0712
1060765	OU1-GW-P-9-0712
1060781	OU1-GW-MW402-0712

1060782	OU1-GW-G-04-0712
1060783	OU1-GW-MW405-0712
1060784	OU1-GW-MW401-0712
1060785	OU1-GW-MW404-0712
1060786	SOLUBLE OU1-GW-G-101-0712
1060787	SOLUBLE OU1-GW-MW-A-0712
1060788	SOLUBLE OU1-GW-MW404-071
1060789	SOLUBLE OU1-GW-G-04-0712

Matrix – groundwater, 3 aqueous trip blank, 1 aqueous field blank and 1 aqueous equipment blank

Executive Summary

All analyses were performed as requested on the chain of custody (COC), except as noted below.

Sample OU1-GW-G-101-0712 was not analyzed for volatiles by EPA Method 8260B, although requested on the COC. In addition, this sample was analyzed for TOC, although the COC did not request that analysis. Based on email communication between the laboratory and client, the sample was collected in the bottle preserved with sulfuric acid, which is appropriate to the TOC analysis; therefore, the volatiles analysis could not be performed since some organic compounds break down with sulfuric acid preservation.

The methods listed on the COC for TOC analysis and ortho-phosphate analysis were EPA Method 9060 and EPA Method 300.0/9056, respectively. The methods used by the laboratory for analysis were EPA Method 415.1 for TOC and EPA Method 365.1 for ortho-phosphate.

The collection dates for the samples on the COC did not list the year; for example, the collection date was listed as 12/5.

Incorrect error correction was observed on the COC instead of the proper procedure of a single strike through, correction, and initials and date of person making the correction.

All holding times were met, with the exception of the ortho-phosphate analyses of samples OU1-GW-G-02-0712 and OU1-GW-G-04-0712. Both samples were received after the 48 hour holding time had expired. The samples were analyzed within 96 hours of sample collection, per instructions from the client.

1.0 Volatile Organic Compounds (EPA Method 8260B)

Full validation including recalculation was performed with the laboratory data for the analysis of volatile organic compounds (EPA Method 8260B). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Internal Standards
- ✓ Performance Check Sample
- ⊗ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Matrix Spike/Matrix Spike Duplicate Sample
- ✓ Laboratory Control Samples
- ✓ Compound Identification and Quantitation

1.1 Data Completeness

All analyses were performed as requested on the COC.

1.2 Holding Times and Preservation

All samples were analyzed within the 14 day technical holding time from date of collection for volatiles.

1.3 Calibrations

1.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the percent relative standard deviation (%RSD) of the relative response factors (RRFs). For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

1.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria.

1.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts.

1.5 Performance Check Samples

An instrument performance check sample (tune standard) was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for bromofluorobenzene (BFB).

1.6 Blanks

Methylene chloride was detected in the method blank, at an estimated concentration greater than the method detection limit (MDL) but less than the reporting limit (RL).

Therefore, the estimated concentrations of methylene chloride in the samples greater than the MDL but less than the RL are U qualified as not detected at the RL.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-GW-MW-A-0712	Methylene chloride	0.24 JB	1.0 U
OU1-GW-MW404-0712	Methylene chloride	0.26 JB	1.0 U
OU1-GW-MW402-0712	Methylene chloride	0.28 JB	1.0 U
OU1-GW-MW405-0712	Methylene chloride	0.27 JB	1.0 U
OU1-GW-MW401-0712	Methylene chloride	0.22 JB	1.0 U

Sample OU1-GW-MW402-0712 was submitted as the trip blank. Acetone and methylene chloride were detected in the trip blank at estimated concentrations greater than the MDL, but less than the RL. Acetone was not detected in the associated samples and as noted above, methylene chloride was detected in the laboratory method blank resulting in qualification of the associated samples including the trip blank. No additional sample qualifications were made to the methylene chloride concentrations in the samples based on the trip blank results.

Sample OU1-GW-MW405-0712 was submitted as the field blank. Acetone, 2-butanone and methylene chloride were detected in the field blank at estimated concentrations greater than the MDL, but less than the RL. Acetone and 2-butanone were not detected in the associated samples, and again as noted above, methylene chloride was detected in the laboratory method blank resulting in the qualification of the associated samples including the field blank. No additional sample qualifications were made to the methylene chloride concentrations in the associated samples based on the field blank results.

Sample OU1-GW-MW401-0712 was submitted as the equipment blank. Acetone, 2-butanone and methylene chloride were detected in the equipment blank at estimated concentrations greater than the MDL, but less than the RL. Acetone and 2-butanone were not detected in the associated samples, and as noted above, methylene chloride was detected in the laboratory method blank and associated samples including the equipment blank. No additional sample qualifications were made to the methylene chloride concentrations in the associated samples based on the equipment blank results.

1.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

1.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits.

1.9 Matrix Spike/Matrix Spike Duplicate Sample (MS/MSD)

Sample OU1-GW-MW-A-0712 was analyzed as the MS/MSD. All recoveries and RPDs were within the laboratory control limits.

1.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

2.0 Semivolatile Organic Compounds (EPA Method 8270C)

Full validation including recalculation was performed on the laboratory data for the analysis of semivolatile organic compounds (EPA Method 8270C). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ⊗ Calibrations
- ✓ Internal Standards
- ⊗ Performance Check Sample
- ⊗ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ⊗ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

2.1 Data Completeness

All analyses were performed as requested on the COC.

2.2 Holding Times and Preservation

The samples for semivolatile analysis were extracted within the 7 day technical holding time from date of collection and analyzed within the 40 day technical holding time from date of extraction.

2.3 Calibrations

2.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the RRFs. For all target analytes, the RRFs met the method criteria; the RSDs met the method or validation criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations. It was noted that linear curve fits using only 5 points were used for 2,4-dinitrophenol and pentachlorophenol; Method 8000 requires the use of a minimum of 6 points for linear curve fits. However, based on professional judgment, no sample qualifications were made.

2.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration

standards for all target analytes were within the method or validation acceptance criteria.

2.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts.

2.5 Performance Check Samples

An instrument performance check sample was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for decafluorotriphenylphosphine (DFTPP). It was noted that on all 5B Forms, the percent relative abundances for mass 441 compared to mass 443 were wrong. However, the raw data confirmed that mass 441 passed the method criteria; therefore, no sample qualifications were required. The laboratory was notified of the error.

2.6 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

Sample OU1-GW-MW401-0712 was submitted as the equipment blank. The following compounds were detected in the equipment blank: Bis(2-ethylhexylphthalate, fluoranthene and phenanthrene. However, since none of these compounds were detected in the associated samples, no sample qualifications were required.

2.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

2.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits, with the exception of benzaldehyde, which had high recoveries, outside of the laboratory control limits, in the LCS and LCSD. However, since benzaldehyde was not detected in any of the samples, no sample qualifications were required. Additionally, 3-Nitroaniline recovery in the LCS was low and outside of the laboratory control limits. Therefore, the undetected concentrations of 3-nitroaniline in the samples are UJ qualified as estimated less than the RL.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-GW-101-0712	3-Nitroaniline	50 U	50 UJ
OU1-GW-MW-A-0712	3-Nitroaniline	47 U	47 UJ
OU1-GW-MW404-0712	3-Nitroaniline	47 U	47 UJ
OU1-GW-MW401-0712	3-Nitroaniline	47 U	47 UJ

2.9 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Sample OU1-GW-MW-A-0712 was analyzed as the MS/MSD. All recoveries and RPDs were within the laboratory control limits, with the following exceptions. Benzaldehyde recoveries in the MS/MSD were high and outside of the laboratory control limits. However, since benzaldehyde was not detected in sample OU1-GW-MW-A-0712, no sample qualifications were required. The following compounds had low recoveries outside of the laboratory control limits in the MS and/or MSD: 3,3'-dichlorobenzidine, 3-nitroaniline, and 4-nitroaniline. Therefore, the undetected concentrations of 3,3'-dichlorobenzidine, 3-nitroaniline, and 4-nitroaniline in sample OU1-GW-MW-A-0712 are UJ qualified as estimated less than the RL.

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-GW-MW-A-0712	3-Nitroaniline	47 U	47 UJ
	4-Nitroaniline	47 U	47 UJ
	3,3'- Dichlorobenzidine	9.4 U	9.4 UJ

2.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

3.0 Metals (EPA Methods 6020/6010B/7470A)

The water samples were analyzed for the requested total and dissolved metals and Mercury (EPA 6020/6010B/7470A/7471A) following metals digestion and mercury digestion. Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ⊗ Laboratory Duplicate Samples
- ⊗ Serial Dilutions
- ✓ Compound Identification and Quantitation

3.1 Data Completeness

All analyses were performed as requested on the COC.

3.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

3.3 Calibrations

3.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

3.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits.

3.3.3 CRDL (Detection Limit) Standard

The CRDL standards were within the control limits.

3.3.4 ICSA/ICSAB (Interference Check) Standards

The ICSA/ICSAB standards met all acceptance criteria.

3.4 Blanks

3.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria, with the following exceptions; antimony, arsenic, chromium, copper, manganese and vanadium were detected in the preparation blank at estimated concentrations less than the RL, but greater than the instrument detection limits (IDL). However, since arsenic, copper, manganese and vanadium were either not detected or detected in the associated samples at concentrations greater than the RL, no sample qualifications were required. Several samples had antimony and/or chromium concentrations at estimated concentrations less than the RL, but greater than the IDL; for these samples, the concentrations of antimony and/or chromium are U qualified as not detected at the RL.

Sample	Metal	Laboratory Concentration (ug/L)	Validation concentration (ug/L)
OU1-GW-G-101-0712	Chromium	1.5 B	3.0 U
	Dissolved Chromium	1.2 B	3.0 U
OU1-GW-P-9-0712	Antimony	0.484 B	1.0 U
	Chromium	1.3 B	3.0 U
OU1-GW-G-04-0712	Chromium	1.9 B	3.0 U
OU1-GW-MW405-0712	Chromium	1.3 B	3.0 U
OU1-GW-MW401-0712	Antimony	0.406 B	1.0 U
	Chromium	2.6 B	3.0 U

3.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria, with the following exceptions. Antimony, arsenic, magnesium, manganese, sodium and selenium were detected in the ICB and/or CCB at concentrations less than the RL, but greater than the IDL. However, since arsenic, magnesium and manganese were either

not detected or detected in the associated samples at concentrations greater than the RL, no sample qualifications were required.

The samples were analyzed at a five fold dilution for arsenic and selenium. Due to the concentrations of arsenic and selenium in several samples as compared to the associated ICB or CCBs concentrations of arsenic and selenium, the arsenic and selenium concentrations detected in the samples at concentrations less than the RL, but greater than the IDL are U qualified as undetected at the RL or reported at an elevated RL, based on professional judgment.

Samples OU1-GW-MW405-0712 and OU1-GW-MW401-0712 had estimated sodium concentrations less than the RL but greater than the IDL. The associated CCBs also had estimated sodium concentrations less than the RL but greater than the IDL; therefore, the sodium concentrations in samples OU1-GW-MW405-0712 and OU1-GW-MW401-0712 are U qualified as undetected at the RL.

Sample	Metal	Laboratory Concentration (ug/L)	Validation concentration (ug/L)
OU1-GW-MW404-0712	Selenium	1.6 B	5.0 U
	Dissolved Arsenic	1.6 B	5.0 U
	Dissolved Selenium	7.6	7.6 U
OU1-GW-P-7-0712	Arsenic	1.3 B	5.0 U
	Selenium	2.6 B	5.0 U
OU1-GW-P-9-0712	Arsenic	3.4 B	5.0 U
	Selenium	2.7 B	5.0 U
OU1-GW-G-04-0712	Arsenic	2.1 B	5.0 U
	Dissolved Arsenic	1.7 B	5.0 U
	Dissolved Selenium	5.3	5.3 U
OU1-GW-MW405-0712	Arsenic	0.574 B	5.0 U
	Selenium	4.0 B	5.0 U
	Sodium	75.9 B	5000 U
OU1-GW-MW401-0712	Arsenic	1.3 B	5.0 U
	Selenium	4.8 B	5.0 U
	Sodium	288 B	5000 U
OU1-GW-G-101-07	Dissolved Arsenic	1.9 B	5.0 U
	Dissolved Selenium	6.2	6.2 U
OU1-GW-MW-A-0712	Dissolved Arsenic	1.3 B	5.0 U
	Dissolved Selenium	6.2	6.2 U

3.5 Laboratory Control Samples (LCS)

All percent recoveries in the LCS were within the acceptance limits.

3.6 Matrix Spike (MS)

Sample OU1-GW-MW-A-0712 was analyzed as a total metals MS. The compound recoveries were within the laboratory control limits, with the following exceptions. Calcium, magnesium, manganese, nickel, potassium, and zinc recoveries were high and outside of the laboratory control limits; however, since the sample concentrations were greater than four times the spike concentrations, no sample qualifications were required.

Sample OU1-GW-G-04-0712 was analyzed as a total metals MS. The recoveries were within the laboratory control limits, with the following exceptions. Calcium recovery was high and magnesium recovery was low, both outside of the laboratory control limits; however, since the sample concentrations were greater than four times the spike concentrations, no sample qualifications were required.

Sample OU1-GW-MW-A-0712 was analyzed as the dissolved metals MS. The recoveries were within the laboratory control limits, with the following exceptions. Calcium, magnesium, nickel and sodium recoveries were low and outside of the laboratory control limits; however, since the sample concentrations were greater than four times the spike concentrations, no sample qualifications were required.

3.7 Laboratory Duplicate Samples

Sample OU1-GW-MW-A-0712 was analyzed as the laboratory duplicate for both total and dissolved metals. The RPD results were acceptable, with the following exceptions. Selenium and silver had high RPD results for the total metals analysis, outside of the laboratory control limits; however, since the total selenium and silver concentrations in sample OU1-GW-MW-A-0712 are less than five times the RL, no sample qualifications are required.

Sample OU1-GW-G-04-0712 was analyzed as a total metals laboratory duplicate. The RPD results were acceptable, with the exception of silver; however, since the silver concentration in sample OU1-GW-G-04-0712 is less than five times the RL, no sample qualifications are required.

3.8 Serial Dilutions

The percent differences for the compounds for the serial dilution for the total metals analysis of sample OU1-GW-MW-A-0712 were outside of the laboratory acceptance criteria for selenium and silver; however, these metals concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required.

The percent differences for the compounds for the serial dilution for the total metals analysis of sample OU1-GW-G-04-0712 were outside of the laboratory acceptance criteria for aluminum, antimony, arsenic, chromium, copper, lead, selenium and silver; however, these metals concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required.

The percent differences for the compounds for the serial dilution for the dissolved metals analysis of sample OUI-GW-MW-A-0712 were outside of the laboratory acceptance criteria for antimony, arsenic, selenium and silver; however, these metals concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required.

3.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

Four samples were analyzed for both total and dissolved metals. All four samples had some total metals concentrations less than the dissolved metals concentrations. In each of these three samples, the difference between the total and dissolved metals concentrations were less than 10% for most metals; however, for samples with percent difference greater than 10%, the total and dissolved metals concentrations are J qualified as estimated. The following table summarizes the percent differences between the total and dissolved iron concentrations and the appropriate qualifications for these four samples.

Sample	Metal	Total Concentration (ug/L)	Dissolved Concentration (ug/L)	Percent Difference (%)	Total Validation Result (ug/L)	Dissolved Validation Result (ug/L)
OUI-GW-G-101-0712	Barium	32.9	33.1	1	NA	NA
	Calcium	250000	253000	1	NA	NA
	Magnesium	132000	135000	2	NA	NA
	Nickel	18.7	21.3	13	18.7 J	21.3 J
	Potassium	13900	14000	1	NA	NA
	Sodium	272000	275000	1	NA	NA
OUI-GW-MW-A-0712	Cadmium	81.5	82.4	1	NA	NA
	Cobalt	4.5 B	4.7 B	4	NA	NA
	Copper	6.3	6.5	3	NA	NA
	Magnesium	80100	81200	1	NA	NA
	Manganese	4470	4540	2	NA	NA
	Nickel	80.6	97.4	19	80.6 J	97.4 J
	Potassium	111000	113000	2	NA	NA
OUI-GW-MW-404--0712	Cadmium	81.8	82.9	1	NA	NA
	Calcium	720000	703000	2	NA	NA
OUI-GW-G-04-0712	Cobalt	3.1 B	3.2 B	3	NA	NA
	Nickel	13.8	14.9	8	NA	NA

NA-not applicable

The concentrations of some compounds in the samples were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the IDL. These concentrations are J qualified as estimated.

Sample	Metal	Laboratory Concentration (ug/L)	Validation concentration (ug/L)
OU1-GW-G-101-0712	Cobalt	2.0 B	2.0 J
	Lead	0.736 B	0.736 J
	Manganese	6.8 B	6.8 J
	Thallium	0.451 B	0.451 J
	Zinc	19.9 B	19.9 J
	Dissolved Cobalt	2.1 B	2.1 J
	Dissolved Manganese	1.1 B	1.1 J
	Dissolved Zinc	10.7 B	10.7 J
OU1-GW-G-02-0712	Arsenic	1.1 B	1.1 J
	Cadmium	2.1 B	2.1 J
	Lead	2.4 B	2.4 J
	Silver	6.7 B	6.7 J
OU1-GW-MW-A-0712	Cobalt	4.5 B	4.5 J
	Selenium	1.2 B	1.2 J
	Silver	8.6 B	8.6 J
	Dissolved Cobalt	4.7 B	4.7 J
	Dissolved Silver	7.8 B	7.8 J
OU1-GW-MW404-0712	Cobalt	4.7 B	4.7 J
	Silver	7.8 B	7.8 J
	Dissolved Cobalt	4.6 B	4.6 J
	Dissolved Silver	6.0 B	6.0 J
OU1-GW-P-7-0712	Aluminum	86.3 B	86.3 J
	Cadmium	2.7 B	2.7 J
	Chromium	3.4 B	3.4 J
	Copper	4.6 B	4.6 J
	Lead	0.645 B	0.645 J
OU1-GW-P-9-0712	Cadmium	1.8 B	1.8 J
	Copper	2.7 B	2.7 J
	Silver	9.3 B	9.3 J
OU1-GW-G-04-0712	Aluminum	57.6 B	57.6 J
	Cobalt	3.1 B	3.1 J
	Copper	1.3 B	1.3 J
	Lead	1.5 B	1.5 J
	Selenium	0.988 B	0.988 J
	Silver	4.4 B	4.4 J
	Dissolved Cobalt	3.2 B	3.2 J
	Dissolved Copper	0.528 B	0.528 J
	Dissolved Lead	0.724 B	0.724 J
	Dissolved Silver	3.9 B	3.9 J

OU1-GW-MW405-0712	Calcium	33.0 B	33.0 J
	Copper	2.8 B	2.8 J
	Zinc	4.1 B	4.1 J
OU1-GW-MW401-0712	Barium	3.5 B	3.5 J
	Calcium	332 B	332 J
	Copper	3.7 B	3.7 J
	Lead	1.1 B	1.1 J
	Magnesium	43.3 B	43.3 J
	Nickel	1.1 B	1.1 J
	Potassium	158 B	158 J

4.0 Cyanide (EPA Method 9012), Total Organic Carbon (EPA Method 415.1), Sulfate (EPA Method 300.0) and ortho-Phosphate (EPA Method 365.1)

The water samples were analyzed for cyanide (EPA Method 9012), total organic carbon (TOC EPA Method 415.1), sulfate (EPA Method 300.0) and ortho-phosphate (EPA Method 365.1). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ⊗ Data Completeness
- ⊗ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ Laboratory Control Sample
- ⊗ Matrix Spike Sample
- ⊗ Laboratory Duplicate Sample

4.1 Data Completeness

All analyses were performed as requested on the COC, with the following exceptions. The methods listed on the COC for TOC analysis and ortho-phosphate analysis were EPA 9060 and EPA 300.0/9056, respectively. The methods used by the laboratory for analysis were EPA 415.1 for TOC and EPA 365.1 for ortho-phosphate.

4.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times, with the following exceptions. Method 365.1 states that samples for ortho-phosphate must be preserved with sulfuric acid and analyzed within 28 days of collection. The samples were not preserved with sulfuric acid and were analyzed with 48 hours of collection (the ortho-phosphate holding time for unpreserved samples listed for EPA Method 300.0), with the exception of samples OU1-GW-G-02-0712 and OU1-GW-G-04-0712, which were analyzed within 3 days of collection. Therefore, the ortho-

phosphate concentrations in samples OU1-GW-G-02-0712 and OU1-GW-G-04-0712 are UJ qualified as not detected less than the RL and J qualified as estimated.

Sample	Compound	Laboratory Concentration (mg/L)	Validation concentration (mg/L)
OU1-GW-G-02-0712	Ortho-phosphate	0.0100 U	0.0100 UJ
OU1-GW-G-04-0712	Ortho-phosphate	0.0126	0.0126 J

4.3 Calibrations

4.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for all analyses.

4.3.2 Continuing Calibration Verification (CCV)

The percent recoveries in all associated CCVs were within the QC acceptance limits for all analyses.

4.4 Blanks

4.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria; no compounds were detected in the method blanks.

4.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICB and CCBs met the acceptance criteria; no compounds were detected in either the ICB or CCBs.

4.5 Laboratory Control Sample (LCS)

The percent recoveries in the LCSs were within the acceptance limits for all analyses.

4.6 Matrix Spike (MS)

Sample OU1-GW-G-04-0712 was analyzed as the MS for ortho-phosphate, TOC and sulfate analyses. The percent recoveries were within the acceptance limits.

Sample OU1-GW-MW-A-0712 was analyzed as the MS for the cyanide analysis. The percent recovery was within the acceptance limits.

4.7 Laboratory Duplicate Samples

Sample OU1-GW-G-04-0712 was analyzed as the laboratory duplicate for ortho-phosphate, TOC and sulfate analyses. The RPDs were within the acceptance limits.

Sample OU1-GW-MW-A-0712 was analyzed as the laboratory duplicate for the cyanide analysis. Cyanide was not detected in either the sample or the duplicate.

ATTACHMENT A
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by GeoSyntec's Data Review Team

DATA QUALIFIER DEFINITIONS

- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Memorandum

TO: Nandra Weeks

DATE: March 11, 2008

FROM: Geosyntec Consultants QA/QC Group

SITE: Mattheissen and Hegeler Zinc Company Site, OU1

SUBJECT: Summary of Tier III Validation of analytical results for CAS Report R2841757

Introduction

This report summarizes the findings of the full validation of 5 groundwater samples, three trip blanks, one field blank and one equipment blank collected on behalf of the Mattheissen and Hegeler Zinc Company Site, OU1 project. These samples were collected on January 14, 15 and 17, 2008. The samples were analyzed by Columbia Analytical Services, Inc. (CAS), Rochester, New York. The samples were analyzed for Volatile Organic Compounds by EPA Method 8260B, Semivolatile Organic Compounds by EPA Method 8270C, Total and Dissolved metals by EPA Methods 6020 and 6010B, Total and Dissolved Mercury by EPA Method 7470A, Total Organic Carbon (TOC) by EPA Method 415.1, Cyanide by EPA Method 9012A, Sulfate by EPA Method 300.0 and ortho-Phosphate by EPA Method 365.1.

The data were reviewed in accordance with the principles presented in *USEPA National Functional Guidelines for Laboratory Data Review, Organics* (EPA, 2005), *USEPA National Functional Guidelines for Laboratory Data Review, Inorganics* (EPA, 2004), and per the requirements of the QAPP, the laboratory standard operating procedures and the specified methods.

Data for the following samples were reviewed.

Lab ID	Client ID
1068961	OU1-GW-MWZ
1068962	Soluble OU1-GW-MWZ
1068963	OU1-GW-P-18
1068972	OU1-GW-MW402
1069681	OU1-GW-P-17
1069683	OU1-GW-MW-321-H
1069687	OU1-GW-MW-322-H

1069690	OU1-GW-MW-402
1070091	OU1-GW-MW-401
1070094	OU1-GW-MW402
1070097	OU1-GW-MW405

Matrix – groundwater, 3 aqueous trip blank, 1 aqueous field blank and 1 aqueous equipment blank

Executive Summary

All analyses were performed as requested on the chain of custody (COC) , except as noted below.

There were no methods listed on the COC for TOC, cyanide, sulfate and ortho-phosphate analyses. The methods used by the laboratory for analysis were EPA Method 415.1, EPA Method 9012A, EPA Method 300.0 and EPA Method 365.1, respectively.

The collection dates for the trip blanks on the COC did not match the collection dates used by the laboratory. The laboratory assigned the trip blank collection date the same as the associated samples. This has no impact on the data. See the table below.

Lab ID	Client ID	COC Collection Date	Lab Collection Date
1068972	OU1-GW-MW402	1/4/08	1/14/08
1069690	OU1-GW-MW-402	1/4/08	1/15/08
1070094	OU1-GW-MW402	1/4/08	1/17/08

Incorrect error correction was observed on the COC instead of the proper procedure of a single strike through, correction, and initials and date of person making the correction.

All holding times were met.

1.0 Volatile Organic Compounds (EPA Method 8260B)

Full validation including recalculation was performed with the laboratory data for the analysis of volatile organic compounds (EPA Method 8260B). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ⊗ Calibrations
- ✓ Internal Standards

- ✓ Performance Check Sample
- ⊗ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ✓ Matrix Spike/Matrix Spike Duplicate Sample
- ✓ Laboratory Control Samples
- ✓ Compound Identification and Quantitation

1.1 Data Completeness

All analyses were performed as requested on the COC.

1.2 Holding Times and Preservation

All samples were analyzed within the 14 day technical holding time from date of collection for volatiles.

1.3 Calibrations

1.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the percent relative standard deviation (%RSD) of the relative response factors (RRFs). For all target analytes, the RRFs met the method criteria; the RSDs met the method criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

1.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method acceptance criteria, with the following exceptions. Dichlorodifluoromethane in the CCV analyzed on 1/17/08 and 1,1,2,2-tetrachloroethane in the CCV analyzed on 1/19/08 were outside of the acceptance criteria. Therefore, the undetected concentrations of dichlorodifluoromethane and 1,1,2,2-tetrachloroethane in the associated samples are UJ qualified as estimated below the reporting limit (RL).

Sample ID	Compound	Laboratory Result (ug/L)	Validation Result (ug/L)
OU1-GW-MWZ	Dichlorodifluoromethane	1.0 U	1.0 UJ
OU1-GW-MW402	Dichlorodifluoromethane	1.0 U	1.0 UJ
OU1-GW-MW-322-H	1,1,2,2-Tetrachloroethane	1.0 U	1.0 UJ
OU1-GW-MW-402	1,1,2,2-Tetrachloroethane	1.0 U	1.0 UJ

1.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts.

1.5 Performance Check Samples

An instrument performance check sample (tune standard) was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for bromofluorobenzene (BFB).

1.6 Blanks

There were no detections of the project compounds of concern in laboratory method blanks.

Three trip blanks, all with the client ID OU1-GW-MW402, were submitted. Acetone was detected in the trip blank associated with the samples collected on 1/15/08, at an estimated concentration greater than the method detection limit (MDL), but less than the RL. However, since acetone was not detected in the associated samples, no sample qualifications were required.

Sample OU1-GW-MW405 was submitted as the field blank. Acetone and 2-butanone were detected in the field blank at estimated concentrations less than the RL, but greater than the MDL; bromodichloromethane and chloroform were detected in the field blank at a concentrations greater than the RL. However, acetone, 2-butanone, bromodichloromethane and chloroform were not detected in the associated samples; therefore, no sample qualifications were required.

Sample OU1-GW-MW401 was submitted as the equipment blank. Acetone and 2-butanone were detected in the equipment blank at estimated concentrations less than the RL, but greater than the MDL; bromodichloromethane and chloroform were detected in the field blank at a concentrations greater than the RL. However, acetone, 2-butanone, bromodichloromethane and chloroform were not detected in the associated samples; therefore, no sample qualifications were required.

1.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

1.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits.

1.9 Matrix Spike/Matrix Spike Duplicate Sample (MS/MSD)

A MS/MSD pair was not analyzed.

1.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

2.0 Semivolatile Organic Compounds (EPA Method 8270C)

Full validation including recalculation was performed on the laboratory data for the analysis of semivolatile organic compounds (EPA Method 8270C). The laboratory data were reviewed to evaluate compliance with this method, and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Internal Standards
- ⊗ Performance Check Sample
- ✓ Blanks
- ✓ System Monitoring Compounds (Surrogates)
- ⊗ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate
- ✓ Compound Identification and Quantitation

2.1 Data Completeness

All analyses were performed as requested on the COC.

2.2 Holding Times and Preservation

The samples for semivolatile analysis were extracted within the 7 day technical holding time from date of collection and analyzed within the 40 day technical holding time from date of extraction.

2.3 Calibrations

2.3.1 Initial Calibrations (ICAL)

Appropriate initial calibrations were performed for each analyte. Based on the method of calibration, the laboratory calculated the %RSD of the RRFs. For all target analytes, the RRFs met the method criteria; the RSDs met the method or validation criteria for all compounds or the coefficient of determination (r^2) was greater than or equal to 0.990 for the curve fit calibrations.

2.3.2 Continuing Calibration Verification (CCV)

For all target analytes, the RRFs met the method criteria; the percent differences (%D) between the RRFs in the initial and continuing calibration standards for all target analytes were within the method or validation acceptance criteria.

2.4 Internal Standards

All internal standard retention times are within ± 30 seconds of the associated continuing calibration internal standard retention time. All internal standard area counts were within the acceptance criteria ($>50\%$ and $<150\%$) of the associated continuing calibration internal standard area counts.

2.5 Performance Check Samples

An instrument performance check sample was analyzed at the beginning of each 12-hour period during sample analysis. The samples were analyzed within the 12-hour period. All ion abundance criteria were met for decafluorotriphenylphosphine (DFTPP). It was noted that on all 5B Forms, the percent relative abundances for mass 441 compared to mass 443 were wrong. However, the raw data confirmed that mass 441 passed the method criteria; therefore, no sample qualifications were required.

2.6 Blanks

There were no detections of the project compounds of concern in the laboratory method blank.

Sample OU1-GW-MW401 was submitted as the equipment blank. No compounds of concern were detected in the equipment blank.

2.7 System Monitoring Compounds (Surrogates)

All surrogate recoveries were within the laboratory acceptance limits.

2.8 Laboratory Control Samples (LCS)

All LCS recoveries were within the laboratory control limits, with the exception of benzaldehyde, which had high recoveries, outside of the laboratory control limits, in the both LCSs and one LCSD. However, since benzaldehyde was not detected in any of the samples, no sample qualifications were required.

2.9 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

A MS/MSD pair was not analyzed.

2.10 Compound Identification and Quantitation

All compound identifications and quantitations were appropriate.

3.0 Metals (EPA Methods 6020/6010B/7470A)

The water samples were analyzed for the requested total and dissolved metals and Mercury (EPA 6020/6010B/7470A/7471A) following metals digestion and mercury digestion. Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPS and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations

- ✓ Blanks
- ✓ Laboratory Control Samples
- ⊗ Matrix Spike/Matrix Spike Duplicate Samples
- ⊗ Laboratory Duplicate Samples
- ⊗ Serial Dilutions
- ✓ Compound Identification and Quantitation

3.1 Data Completeness

All analyses were performed as requested on the COC. The data package sample results were not reported down to the instrument detection limit (IDL). The laboratory provided corrected forms by email.

3.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

3.3 Calibrations

3.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for inductively coupled plasma/mass spectrometry (ICP/MS) analysis, inductively coupled plasma (ICP) analysis and cold vapor atomic absorption (CVAA) initial calibrations.

3.3.2 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The percent recoveries in all associated ICVs and CCVs were within the QC acceptance limits.

3.3.3 CRDL (Detection Limit) Standard

The CRDL standards were within the control limits, with the following exception. Selenium had high recovery in the closing CRDL standard, outside of the method acceptance limits. However, based on professional judgment, no sample qualifications were made; all the selenium results were qualified due blank concentrations (see section 3.4 below).

3.3.4 ICSA/ICSAB (Interference Check) Standards

The ICSA/ICSAB standards met all acceptance criteria.

3.4 Blanks

3.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria, with the following exceptions; antimony, arsenic, chromium, copper, lead, nickel, selenium, and vanadium were detected in the preparation blank at estimated concentrations less than the RL, but greater than the IDL. However, since arsenic and vanadium were either not detected or detected in the associated samples at concentrations greater than the RL, no sample qualifications were required. For the samples with antimony, chromium, copper, lead, nickel, and selenium concentrations less than the RL, but greater than the IDL, the concentrations are U qualified as not detected at the RL.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-GW-MWZ	Chromium	2.2 B	3.0 U
	Selenium	0.297 B	2.0 U
	Dissolved Antimony	0.394 B	1.0 U
	Dissolved Chromium	1.0 B	3.0 U
	Dissolved Selenium	0.168 B	2.0 U
OU1-GW-P-18	Antimony	0.271 B	1.0 U
	Chromium	1.1 B	3.0 U
	Lead	0.293 B	1.0 U
OU1-GW-P-17	Antimony	0.827 B	1.0 U
	Chromium	1.5 B	3.0 U
	Selenium	0.390 B	2.0 U
OU1-GW-MW-321-H	Antimony	0.668 B	1.0 U
	Chromium	2.6 B	3.0 U
	Selenium	1.1 B	2.0 U
OU1-GW-MW-322-H	Antimony	0.250 B	1.0 U
	Chromium	1.5 B	3.0 U
	Selenium	1.6 B	2.0 U
OU1-GW-MW-401	Antimony	0.171 B	1.0 U
	Chromium	1.5 B	3.0 U
	Copper	0.345 B	1.0 U
	Nickel	0.167 B	1.0 U
	Selenium	0.336 B	2.0 U
OU1-GW-MW405	Antimony	0.155 B	1.0 U
	Chromium	1.6 B	3.0 U
	Copper	0.340 B	1.0 U
	Nickel	0.081 B	1.0 U
	Selenium	0.364 B	2.0 U

3.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICBs and CCBs met the acceptance criteria, with the following exceptions. Antimony, cadmium, chromium, lead, manganese, selenium silver and sodium were detected in the ICB and/or CCB at estimated concentrations less than the RL, but greater than the IDL. However, since these metals were either not detected or detected in the associated samples at concentrations greater than the RL or were qualified due to the preparation blank concentrations, no additional sample qualifications were required.

3.4.3 Field QC Samples

Sample OU1-SW-MW-401 is the equipment blank and OU1-SW-MW-405 is the field blank. Sodium was detected in both field QC samples at concentrations greater than the RL. The following compounds were detected in each these field blanks at estimated concentrations less than the RL, but greater than the IDL. No soil sample qualifications were required, based on these

detections and the concentrations of the metals in the associated samples or the previous qualifications due to the preparation blank concentrations.

OU1-SW-MW-401 (equipment blank) – antimony, barium, chromium, copper, lead, manganese, nickel, potassium, selenium and zinc.

OU1-SW-MW-405 (field blank) – antimony, chromium, copper, manganese, nickel and selenium.

3.5 Laboratory Control Samples (LCS)

All percent recoveries in the LCS were within the acceptance limits.

3.6 Matrix Spike (MS)

Sample OU1-GW-MWZ was analyzed as the mercury MS. The recovery of mercury was acceptable.

Sample OU1-GW-MW-312-H was analyzed as the metals MS by Method 6010B (ICP). The compound recoveries were within the laboratory control limits, with the exception of calcium and manganese, which were outside of the laboratory control limits. However, since the sample concentrations were greater than four times the spike concentrations, no sample qualifications were required.

Sample OU1-GW-MW-322 H was analyzed as the metals MS by Method 6020 (ICP-MS). The compound recoveries were within the laboratory control limits, with the exception of selenium, which was high and outside of the laboratory control limits. Therefore, the concentration of selenium in sample OU1-GW-MW-322 H is J+ qualified as estimated with a high bias.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-GW-MW-322 H	Selenium	1.6 B	1.6 J+

3.7 Laboratory Duplicate Samples

Sample OU1-GW-MWZ was analyzed as the mercury laboratory duplicate. The RPD result was acceptable.

Sample OU1-GW-MW-312-H was analyzed as the metals laboratory duplicate by Method 6010B (ICP). The RPD results were acceptable.

Sample OU1-GW-MW-322 H was analyzed as the laboratory duplicate by Method 6020 (ICP-MS). The RPD results were acceptable, with the exception of antimony and vanadium, which were high and outside of the laboratory control limits; however, since the antimony and vanadium concentrations in sample OU1-GW-MW-322 H are less than five times the RL, no sample qualifications are required.

3.8 Serial Dilutions

The percent differences for the compounds for the serial dilution by Method 6010B (ICP) of sample OU1-GW-MW-312-H were outside of the laboratory acceptance criteria for aluminum, potassium and silver; however, these metals concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required.

The percent differences for the compounds for the serial dilution by Method 6020 (ICP-MS) of sample OU1-GW-MW-322-H were outside of the laboratory acceptance criteria for antimony, chromium, selenium, and nickel; however, the antimony, chromium and selenium concentrations in the serial dilution are less than 50 times the IDL. Therefore, no sample qualifications are required for the antimony, chromium, and selenium concentrations in sample OU1-GW-MW-322-H. The nickel concentration in sample OU1-GW-MW-322-H is J qualified as estimated, due to the serial dilution results and a sample concentration greater than 50 times the IDL.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-GW-MW-322-H	Nickel	134	134 J

3.9 Compound Identification and Quantitation

The project acceptance limits for the ICP-MS internal standards are 30-170% recovery. All internal standard recoveries were within the project acceptance limits.

One sample was analyzed for both total and dissolved metals. The sample had the total silver concentration slightly less than the dissolved silver concentrations. However, based on professional judgment, no sample qualifications were made.

Sample	Metal	Total Concentration (ug/L)	Dissolved Concentration (ug/L)	Percent Difference (%)	Total Validation Result (ug/L)	Dissolved Validation Result (ug/L)
OUI-GW-MWZ	Silver	1.4 B	1.6 B	NC	NA	NA

NA-not applicable

NC-not calculable

The concentrations of some compounds in the samples were B qualified by the laboratory, indicating an estimated sample concentration less than the RL, but greater than the IDL. These concentrations are J qualified as estimated.

Sample	Metal	Laboratory Concentration (ug/L)	Validation Concentration (ug/L)
OU1-GW-MWZ	Cadmium	0.713 B	0.713 J
	Mercury	0.054 B	0.054 J
	Silver	1.4 B	1.4 J
	Thallium	0.112 B	0.112 J
	Dissolved Silver	1.6 B	1.6 J
OU1-GW-P-18	Silver	0.832 B	0.832 J
OU1-GW-P17	Cadmium	0.456 B	0.456 J
	Mercury	0.038 B	0.038 J
	Silver	1.6 B	1.6 J
OU1-GW-MW-321-H	Cadmium	0.297 B	0.297 J
	Silver	3.8 B	3.8 J
	Vanadium	0.214 B	0.214 J
OU1-GW-MW-322-H	Silver	3.5 B	3.5 J
	Vanadium	0.724 B	0.724 J
OU1-GW-MW-401	Barium	0.452 B	0.452 J
	Lead	0.169 B	0.169 J
	Manganese	3.5 B	3.5 J
	Potassium	182 B	182 J
	Zinc	9.4 B	9.4 J
OU1-GW-MW-405	Manganese	0.423 B	0.423 J

4.0 Cyanide (EPA Method 9012), Total Organic Carbon (EPA Method 415.1), Sulfate (EPA Method 300.0) and ortho-Phosphate (EPA Method 365.1)

The water samples were analyzed for cyanide (EPA Method 9012), total organic carbon (TOC EPA Method 415.1), sulfate (EPA Method 300.0) and ortho-phosphate (EPA Method 365.1). Validation was performed on the laboratory data. The laboratory data were reviewed to evaluate compliance with the methods, laboratory SOPs and the quality of the data reported. The following summarizes the results of this review.

The areas of review are listed below. Those areas that were only reviewed as part of full validation and recalculation are designated below. A leading check mark (✓) indicates an area of review in which all data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ⊗ Data Completeness
- ✓ Holding Times and Preservation
- ✓ Calibrations
- ✓ Blanks
- ✓ Laboratory Control Sample
- ⊗ Matrix Spike Sample
- ⊗ Laboratory Duplicate Sample

4.1 Data Completeness

All analyses were performed as requested on the COC, with the following exceptions. There were no methods listed on the COC for TOC, cyanide, sulfate and ortho-phosphate analyses. The methods used by the laboratory for analysis were EPA Method 415.1, EPA Method 9012A, EPA Method 300.0 and EPA Method 365.1, respectively.

4.2 Holding Times and Preservation

All analyses were performed within the method-specified holding times.

4.3 Calibrations

4.3.1 Initial Calibrations (IC)

All initial calibration requirements were met for all analyses.

4.3.2 Continuing Calibration Verification (CCV)

The percent recoveries in all associated CCVs were within the QC acceptance limits for all analyses.

4.4 Blanks

4.4.1 Preparation (Method) Blank

The preparation blanks met the acceptance criteria; no compounds were detected in the method blanks.

4.4.2 Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB)

The ICB and CCBs met the acceptance criteria; no compounds were detected in either the ICB or CCBs.

4.5 Laboratory Control Sample (LCS)

The percent recoveries in the LCSs were within the acceptance limits for all analyses.

4.6 Matrix Spike (MS)

A MS was not analyzed.

4.7 Laboratory Duplicate Samples

A laboratory duplicate was not analyzed.

ATTACHMENT A
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by GeoSyntec's Data Review Team

DATA QUALIFIER DEFINITIONS

- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to bias attributable to matrix interference.
- UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.